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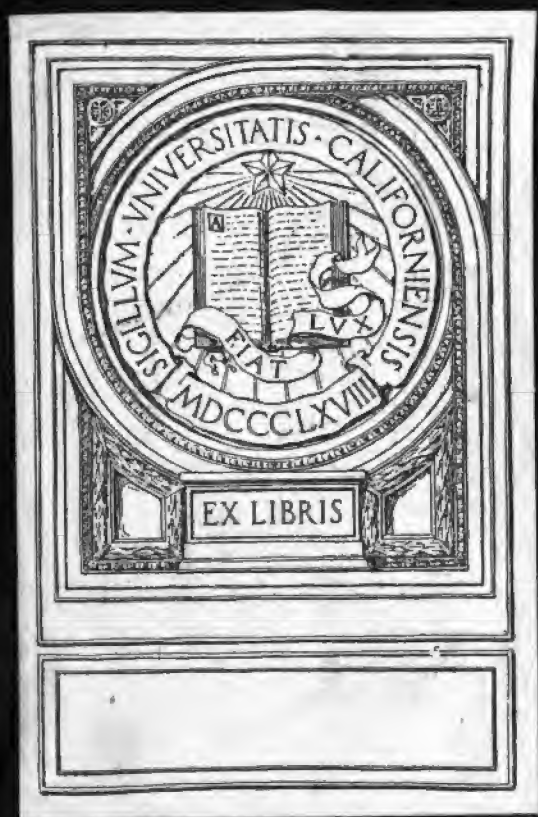
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**A MANUAL OF
ELEMENTARY SEAMANSHIP**

GRIFFIN'S NAUTICAL SERIES.

EDITED BY EDW. BLACKMORE

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AND WRITTEN, MAINLY, by SAILORS for SAILORS.

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A MANUAL OF ELEMENTARY SEAMANSHIP

BY

COMMANDER D. WILSON-BARKER, R.N.R.

MASTER MARINER; F.R.S.E., F.R.G.S.; PAST PRESIDENT R. MET. SOC.
YOUNGER BROTHER OF THE TRINITY HOUSE

With Frontispiece, Twenty-four Plates (Three in
Colours) and Sixty-three Illustrations in the Text

FIFTH EDITION, REVISED

LONDON
CHARLES GRIFFIN AND COMPANY, LIMITED
PHILADELPHIA : J. B. LIPPINCOTT COMPANY

1909

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Gift of the Bohemian Club

TO MR. W. B. ALSTON

Printed by BALLANTYNE & Co. LIMITED
Tavistock Street, Covent Garden, London

20

Dedication

**THIS LITTLE VOLUME IS
AFFECTIONATELY DEDICATED TO
THE MEMORY OF
MY FATHER
DAVID WILSON-BARKER**

699263

PREFACE TO THE FIFTH EDITION

THIS Edition has been revised and brought up to date. It includes a copy of the last Rules of the Road to be learnt by heart for the Board of Trade Examinations. Students are advised to make small models with which to practise the different evolutions and to exercise themselves in signalling.

Seamanship is the art of handling a ship with all its appurtenances and crew. It includes navigation, pilotage, anchoring, avoidance of collision, cargo work, &c. Theoretically its basis is in mathematics and physics. In practice, nerve, judgment, and above all experience make the capable seaman.

Sailors, as a class, are conservative and opposed to change. I would urge all young sailors to study their profession carefully, and to keep themselves informed on all matters connected with it; an easy matter now that so many excellent technical papers are devoted to the progress and welfare of the profession. Whether a young man elects to start in sail or steam he has a wide scope for the putting forth of all his energy and intelligence, if he takes his work in earnest. There is a mistaken idea in some quarters that in steam there is nothing to learn. The exact contrary to the fact. Quite as much nautical knowledge and skill is required as in a sailing ship, though the application is somewhat different.

D. WILSON-BARKER.

GREENHITHE.

PREFACE TO THE THIRD EDITION

THIS Edition has been considerably enlarged and a number of new illustrations added. With the kind assistance of Mr. A. W. Lambert a chapter has been inserted on fore-and-aft sailing, for which Messrs. West supplied photographs.

I am indebted to the Elder Brethren of the Trinity House for the use of photographs of lighthouses, light vessels, and buoys.

Messrs. Bullivant and Co., 72 Mark Lane, kindly lent me blocks of several of their well-known patents, and also supplied me with valuable tables and hints in connection with wire ropes and their fittings.

Messrs. Thomas Walker and Son, of Birmingham, were good enough to furnish illustrations of their patent logs; Messrs. Emerson, Walker and Thompson Bros. Ltd., Gateshead-on-Tyne, of steam winch and windlass; Messrs. Stone and Co., Deptford., of their telegraph apparatus and capstan; and to Lloyd's "Register of Shipping," and to the "Shipping World Year Book" I am indebted for much useful matter.

A chapter of hints and information intended for the benefit of those who contemplate adopting a sea life, or who are actually embarked on such a career, has been added.

D. WILSON-BARKER.

GREENHITHE, *September 1902.*

AUTHOR'S PREFACE

A NEW Elementary Manual of Seamanship may perhaps appear, at first sight, superfluous. Its production has been decided on by the Author because of his conviction that none of the many excellent works extant sufficiently meet the needs of Apprentices and Junior Officers in the Mercantile Marine. This little work is an introductory text-book for beginners ; it does not pretend to complete their nautical education, nor in any sense to supersede that practical training in the details of their profession, an intimate acquaintance with which is so unattainable, except in the course of life on board ship. With a few exceptions the Illustrations are from original Photographs and Drawings by the Author.

The Author hopes, at some future date, to consider and develop more fully, in another volume, many practical problems for the use of advanced students. He is an advocate for collective rather than individual effort in dealing with the many difficult questions pertaining to the profession of the sea, and would gladly receive suggestions on any points from his fellow-sailors, for use in future editions, should such be required.

It should ever be the aim of a young seaman to study the behaviour of the vessel in which he sails, under all possible conditions of weather and sea ; for on a thorough understanding of these points will depend his ability to handle his vessel properly under difficult circumstances.

The Author's best thanks are due to Captain P. Thompson, F.R.A.S. (Secretary, Local Marine Board, London), for many valuable suggestions, and also to Captain A. Walker and other friends for their suggestions in various Sections ; and to Lord Kelvin for his kindness in supplying two of the Illustrations.

GREENHITHE, *October* 1896.

CONTENTS

PART I

THE BUILDING OF A SHIP, PARTS OF HULL, MASTS, ETC.

	PAGE
The Building of a Ship—Launching—The Hull, description of parts—Masts and Spars—Sails—Rigging—Going aloft—Boating—The Mariner's Compass—Marline-spike—Belaying-pins and Cleats—Watches and Time	1-14

PART II

ROPES, KNOTS, SPLICING, ETC.

Knots, Bends, and Hitches, Splicing Ropes—Wire Ropes—Netting—Sennit—Masts and Rigging—Bowsprit—Whippings—Fittings of Yards, Gaffs, &c.	15-40
--	-------

PART III

GEAR, LEAD, AND LOGSHIP, ETC.

Running Gear—Seizings—Lead and Logship—Spanish Windlass—Blocks—Tackles and Purchase.	41-54
--	-------

PART IV

A.—RIGGING, ANCHORS, ETC.

Rigging—Setting up Rigging—Rattling down—Anchors and Cables—Anchoring and Mooring—Laying out an Anchor—Mooring—Tending Ship in Tideway—Sending Yards up and down	55-70
--	-------

PART IV (continued)

B.—SAILMAKING.	71-76
------------------------	-------

PART IV (*continued*)**C.—THE SAILS, ETC.**

	PAGE
Bending and Unbending Sails—Making up Sails—Setting Sail —Taking in Sail—Trimming Sail—Tacking, Wearing, and Heaving-to—Steering Gear—Derricks—Sheers—Fitting Topmasts, Topgallant, and Royal Masts	77-96

PART IV (*continued*)**D.—FORE-AND-AFT SAILING**

Handling of Boats under Sail, &c.—Accidents—Restoring the Apparently Drowned—Rocket Apparatus—Oil on Water	97-112
---	--------

PART V**SIGNALS AND SIGNALLING—RULE OF THE ROAD**

International Code—Signals and Signalling—Commercial Code of Signals—Morse Code—Dipping the Ensign—Rules of the Road—Ship's Lights	113-134
--	---------

PART VI**MECHANICAL APPLIANCES**

Steam Winch—Capstan—Windlass—Telegraphs—Lighthouses and Light-vessels—Sound Signals—Holds and Cargo— Types of Vessels—Tallying—Painting—Hatches—Fire	135-148
--	---------

PART VII**MISCELLANEOUS**

The Sea Life—Examinations—Shipowners—Notes on Points of Etiquette; Keeping and Relieving Watch—Load-Line Marks —Sounding and Displacement Tables—Tables—Ship Tools	149-167
GLOSSARY OF SEA TERMS AND PHRASES	168-190
WEATHER FORECASTING	191-199
QUESTIONS FOR STUDENTS	200-236
INDEX	237-243

DESCRIPTION OF PLATES

PLATE		PAGE
	Rigs of Vessels <i>Frontispiece</i>	
I.	Description of Parts of Hull <i>To face</i>	2
II.	Spars, Sails, and Rigging „	4
IIA.	A Whaler	6
III.	Knots	17
IV.	Knots	18
V.	Hitches, Bends, and Clinches	19
VI.	Bends and Slings	21
VIA.	Cargo Slings	22
VII.	Splices	24
VIII.	Stages of Wire Splicing	25
IX.	Eye Splice (wire)	26
X.	Bullivants' Wire Rope Fittings	30
XI.	Bullivants' Ropes	32
XII.	Tackles	53
XIII.	Cargo Derricks and Fittings round Mast	91
XIV.	Yachts <i>To face</i>	102
XV.	Distant Signals	116
XVI.	Semaphore by Hand Flags	117
XVII.	Merchant Navy Flags (coloured) <i>To face</i>	113
XVIII.	Signal Flags (coloured) „	118
XIX.	National Ensigns for Men-of-War (coloured) „	118
XX.	Diagrams for Practising the Rules of the Road (coloured) <i>To face</i>	120
XXI.	Lighthouses and Light-Vessels „	140
XXII.	Different Types of Vessels	143
XXIII.	Different Types of Vessels	144
XXIV.	General Tools in use on Board Ships	167

DESCRIPTION OF FIGURES

FIG.	PAGE
1. A Boat stowed for Sea	8
2. Mariner's Compass	9
3. Lord Kelvin's Compass	10
4. Top of Compass	11
5. Right and Wrong Way of Belaying a Rope	12
6. Straining Screw	28
7. A Screw for setting up Rigging fitted with Slip Hook	28
8. Comparative size of Thimble and Shackle required for Wire and Hemp Hawasers of equivalent Strength	29
9. Hooks	29
10. Swivel	30
11. Nets	34
12. To worm a Rope	35
13. Parcelling a Rope	36
14. Serving a Rope	37
15. Mainsail. Fore Part	43
16. Fore-and-aft Sail	44
17. Seizings of Rope	45
18. Sounding Machine	48
19. Log-line, &c.	49
20. Patent Log	50
21. Spanish Windlass	51
22. Bullivants' Snatch Block and Single Tackle	54
23. Setting up Rigging	57
24. a. Straining Screw. b. A Screw for Setting up Rigging fitted with Slip Hook	58
25. Rattling down Rigging	59
26. Anchors	61
27. Laying out an Anchor	67
28. Laying out an Anchor (another method)	67
29. Round Seam	73

FIG.	PAGE
30. Flat Seam	74
31. Bending a Mainsail at Sea	78
32. Trimming Sail	82
33. Tacking	86
34. Riggering a Derrick	89
35. Lifting out a Mast with Sheers	90
36. Sending up a Topmast	92
37. Sending up a Topmast	93
38. Sending up a Topmast	94
39. Standing Lug Rig	103
40. Sliding Gunter Rig	103
41. Life-boat fitted with Dipping Lug	105
42. Ship Signal Lamps	133
43. Steam Winch	135
44. Capstan	136
45. Steam Windlass	137
46. Purchase Reel and Patent Nipper	138
47. Bridge—Binnacle, Steam Steering Gear, and Engine-room Telegraph	138
48. Engine-room Telegraphs	139
49. Helm Signalling Apparatus	139
50. Buoys used by the Corporation of the Trinity House	140
51. Load-Line Marks	157
Storm Signals	165
51a. Cumulus (Fine Weather Variety)	192
52. Cumulus (Shower)	193
53. Cumulus (Squall)	192
54. Stratus and Cumulus	194
55. Stratus (Fog)	194
56. Stratus (Fog)	195
57. Stratus (Cirro Cumulus)	196
58. Cirrus	197
59. Stratus (Nimbus Variety)	197
60. Halo	198

TABLES

	PAGE
Watches and Time	13
Bullivants' Steel Wire Ropes	31
Bullivants' Galvanised Flexible Steel Wire Hawasers and Cables compared with Hemp and Chain	33
Dimensions of Chain Cables, &c.	63
Size, Length, Weight of Chains and Anchors, &c.	65
Wheatstone's Morse Table	119
Sounding Table	158
Useful Information in Brief	158
Displacement Table for Draught in Fresh and Salt Water	159
Measures of Length	160
„ Weight	160
„ Area	160
„ Timber	160
„ Coal	161
„ Coke	161
„ Beer	161
„ Wine	161
„ Capacity	161
„ French	162
Converting Knots into Miles	163
Iron Water-tanks—Dimensions and Weight	164
Comparison of Thermometer Scales	165
Correcting Wind Force	166

ELEMENTARY SEAMANSHIP

PART I

THE BUILDING OF A SHIP, PARTS OF HULL, MASTS, ETC.

The Building of a Ship—Launching—The Hull, description of parts—
Masts and Spars—Sails—Rigging—Going aloft—Boating—The
Mariner's Compass—Marline-spike—Belaying-pins and Cleats—
Watches and Time.

BUILDING OF A SHIP.

THE first elements of knowledge to be acquired in regard to a ship are the names of the different parts of the hull, as the general structure of the body of a vessel is called.

The hull consists of a keel, frames, girders or beams, skin or plating, and decks. The keel is the foundation of the ship.

The accompanying Plate I. will familiarise the student with the disposition of the parts of the hull better than any written description could do. He must not, however, content himself with the plate, but must go, book in hand, round the ship, and identify the various parts for himself.

When a ship is to be built, the naval architect prepares his plans according to the dimensions given and the trade for which she is destined. Plans are all drawn to a certain scale ; some parts are separately prepared on larger scales. These plans are taken to the shipyard, where full-sized drawings are made in plan and section, on the "scribe-board," a specially prepared flooring in the mould loft. From the drawings on this board, the templates in wood for the different parts are made ; and the frames, girders, &c., are set off from it, and bent on the bending slab. Meanwhile, the space on which the vessel is to be constructed is prepared ; room is left for launching her into the water ; and a slope arranged down which

she can be slid with the least possible difficulty. A line of blocks is built up on the space, and on these blocks the keel is laid. Poles, on which the staging for building the vessel is erected, are placed at either side of the line of blocks, at a slightly wider distance than the extreme width of the vessel. The keel-plates are laid on the blocks; then the frames, and bow and stern frames, are attached. They are held temporarily in position by means of ribbands. The floor-plates and girders are next added, then the plating and decks; the whole, when fitted together with bolts or rivets, forming a rigid and practically homogeneous structure. A special kind of cradle, called a "launching way," is built under the vessel, in such a manner as to take her weight, and when the vessel is ready for launching, the ways are well greased with Russian tallow, so that she slides easily down them. Engines, boilers, and deck-fittings are put in after launching.

DESCRIPTION OF PARTS OF HULL.

PLATE I.

This plate represents one side * of a modern cargo steamer with the plating removed, and half section, except in No. 2 hold, in which the frames have been carried right round. Necessarily, much detail has been omitted. The water ballast would be carried in the cellular bottom, the depth of which is that of the centre plates, extending upwards about 3 feet from the keel.

The keel is that known as the flat plate-keel.

1 = Bow.	13 = Beams or girders.
1" Stem.	14 Stringers.
2 Stern.	15 Floor-plates.
2' Stern-post.	16 Hatchways.
2" Rudder-post.	17 Ladders.
3 Keel.	V Ventilators.
3' Centre plates of keel.	S Stanchions.
4 Deck-houses.	P Propeller, or screw.
5 Forecastle head.	PT Stern tube.
6 Bridge.	PS Propeller shaft, with joints
7 Poop.	J, and thrust-sock T.
8 Upper deck.	B Bulkheads.
9 Main deck.	A Boiler-room.
10 Lower deck.	C Engine-room.
11 Holds.	F Funnel.
12 Frames.	R Rudder.

Water-tight doors are fitted in many bulkheads, and these doors should close from the upper deck. In the lower part of each bulk-

* The *Starboard* side, the other side is called the *Port* side.



head is also fitted a sluice-valve, which enables water to be run from one compartment to another, and finally to the pumps in the engine-room.

FITTING ALOFT.

Having acquired a general knowledge of the hull of a vessel and its structure, we now run through the names of the masts and spars, of the sails that are attached to and spread on them, and of the rigging, which gives rigidity and movement.

PLATE II.*

SPARS.

I. = Lower mast.	XI. = Lower topsail yard.
II. Topmast.	XII. Upper
III. Topgallant mast.	XIII. Lower topgallant yard.
IV. Royal mast.	XIV. Upper
V. Bowsprit.	XV. Royal yard. "
VI. Jib-boom.	XVI. Tops.
VII. Dolphin striker.	XVII. Crosstrees.
VIII. Spanker boom.	XVIII. Topmast cap.
IX. " gaff.	XIX. Mizzen trysail gaff.
X. Lower yard.	XX. Sheerpole.
X'. Cross-jack yard.	

SAILS.

A = Course.	H = Stays'l.
A' Crossjack.	I Topmast stays'l.
B Lower tops'l.	J Topgallant staysail.
C Upper tops'l.	K Royal staysail.
D Lower topgallant sail.	L Inner jib. } †
E } Upper "	M Outer jib. }
F Royal.	N Mizzen trysail.
G Spanker.	O Main trysail.

P = Fore trysail.

With the exception of the crossjack, the courses and all other sails are distinguished by prefixing the name of the mast on which they are set ; for instance, we have the " main course " or " main-sail," the " main topmast staysail," the " fore topmast staysail," the " lower fore topsail," and so on. But the jibs are known as the " inner jib " and the " outer jib."

* Some details are omitted for the sake of clearness.

† The inner and the outer jib run on their own stays, both of which often go to the topmast head.

RIGGING.

1 = Lower rigging or shrouds.	19 = Spanker boom lift.
1' Cap shrouds.	20 Signal halliards.
2 Topmast rigging or shrouds.	21 Sheets.
3 Topmast backstays.	22 Tacks.
3' Topmast cap backstays.	23 Brails.
4 Topgallant rigging.	24 Lower yard braces.
5 Topgallant backstays.	25 Lower topsail braces.
6 Royal backstays.	26 Upper "
7 Lower stay.	27 Lower topgallant braces.
8 Topmast stay.	28 Upper "
9 Topgallant stay.	29 Royal braces.
10 Royal stay.	30 Lower lifts.
11 Bobstays.	31 Lower topsail lifts, un-
12 Bowsprit shrouds.	hooked when sail set.
13 Jib guys.	32 Upper topsail lifts.
14 Back ropes.	33 Lower topgallant lifts, un-
15 Jib stays, and martingale stay.	hooked when sail set.
16 Futtock rigging.	34 Upper topgallant lifts.
17 Lifts of gaffs.	35 Royal lifts.
18 Vangs.	36 Foot-ropes.

In speaking of sails or gear the identity of any one is marked, as we have seen, by prefixing the name of the mast to which it belongs. For instance, if we wanted to make any allusion to the brace attached to the main yard on the starboard side, we should say the "starboard main brace"; and in like manner we should speak of the "lower main topsail," the "main topmast stays'l," and so on.

RIGS. (*See Frontispiece.*)

Sailing-vessels may be divided into two classes :

(1) Those that only carry fore-and-aft sail, jibs, staysails, spankers, or drivers, and trysails, &c. This style of rigging is known as "*fore-and-aft rig*."

(2) Those that have square sail are called "*square rigged*," and have always fore-and-aft sails as well.

The former can sail closer (within 4 to 5 points) to the wind than the latter (within 6 to 7 points).

Rigs of steamers have the same names as those of sailing-vessels ; thus we speak of a "barque rigged" steamer, or a "fore-and-aft rigged" steamer, &c.

GOING ALOFT.

Going aloft becomes an easy matter with a little practice. It is the custom at sea to go up the weather side, as the "weather-

OF
MORRIS

rigging," being quite tight, is ascended much more easily than the "lee-rigging," which is slack. Ascent of the lee-rigging is also made difficult by the yards which press against the rigging. In going aloft, the hands should take hold of the shrouds, not of the ratlines. The ratlines, where futtock-rigging is fitted, are generally stouter than those on the rigging. The "catch ratline" (as the first on the topmast rigging is called) is particularly stout, as it is the one caught first over the rim of the top.

BOATING.

A sailor should take every opportunity of thoroughly mastering all boating details. At sea, as a rule, he has no chance of acquiring such knowledge; boats are then used only in cases of accident, when ignorance in their manipulation may have serious consequences.

Boats are sometimes built of steel without seams, but generally of wood, clincher fashion, that is, with the planks or strakes overlapping, or in carvel fashion, that is, with the planks flush.

The boats usually carried by sea-going vessels are lifeboats and cutters; all lifeboats are fitted with cork or air-tight chambers. Every boat should have a supply of sails, masts, oars (two spare ones), rowlocks (one spare one), two boat-hooks, bailer, two plugs, two baréas of fresh water, a tin of biscuits, a rudder and tiller. The rowlocks and rudder should be fitted with lanyards.

It is very essential in pulling that the hands should be placed nearly together (about 2" or 3" apart) on the loom of the oar, the elbows being kept close to the sides in the stroke and finish. A good long steady stroke is the proper one. Care should be taken, in feathering the oar on the recovery, to raise the blade well out of the water, so as to clear the waves; if an attempt is made to feather close to the water, as in river rowing, "catching a crab" (being caught by the oar and thrown back into the bottom of the boat) will probably result. In rowing, the oar should be held firmly, but not rigidly. To begin the stroke, the arm should be stretched straight out from the body, which should lean forward so that the oar may enter the water well forward. A firm quick grip should be taken, and kept up in the water. The back should be held straight and square, the head up, and the eyes looking straight to the front. The shoulder and loins should be made to do as much of the work as possible. The higher the boat's side, the heavier will be the work thrown on the shoulders. The legs should take part in the movement, and the feet be placed firmly against the stretcher. The body should work all together, like a pendulum.



PLATE IIa.—A WHALER.

- | | | |
|-----------------|---------------|--------------------------|
| 1. Painter. | 9. Stretcher. | 13. Slings. |
| 2. Head sheets. | 10. Rowlock. | 14. Stern sheets. |
| 3. Thwart. | 11. Gunwale. | 15. Back-board. |
| 4. Oar. | 12. Plug. | 16. Yoke and yoke lines. |
| | 17. Rudder. | |

The stroke should be firm and strong throughout, and should end just abaft the athwart ship line of the rowlock, where the oar should be lifted square out of the water, and feathered for the recovery. "Feathering" is often the weak point in rowing; it is a mistake to attempt it until the other details of pulling have been mastered. A common fault is to feather under water. The oar should be lifted well out, and the recovery made as soon as possible.

The usual orders given in a boat are as follows :

"*Shove off* " ; the boat is pushed off by the bowman and pulling begins.

"*Oars* " or "*lay on your oars* " ; bring the oars to the rest at right angles to the boat's side with blades feathered and level with the gunwale.

"*Hold water* " ; the oars are placed in the water at right angles to the boat's side, to check way ; if pulled backwards the order is "*Back oars,*" or "*Back water.*"

In coming alongside "*bow*" is generally told to *toss* in his oar or lay it fore and aft (the latter when fitted with lanyards) and with boat-hook in hand look out to catch hold of something when coming alongside. *Fenders* of various kinds are used to protect the side of a boat when going alongside.

"*Way enough* " ; oars are laid fore-and-aft or tossed into the boat with blades forward.

The Oar illustrated has leather where it goes in the rowlock; when there is no leather the *loom* extends from grip to blade.

An Officer is sometimes ordered to lower and take off a boat from the ship : this is a less simple operation than it may appear, and is one requiring foresight and method. Let him proceed in the following manner. See that the boat's plug is secure in its place : that oars are ready for shipping : ship outboard rowlocks, pass inboard bow painter and ship rudder. If the ship be going ahead, be careful to unhook the after fall first, and if the ship rolls be particularly careful in lowering or hoisting a boat to fend it off the ship's side. When towing a boat alongside, see that the bight of the tow-line is made fast to the foremost thwart, on the side nearest the ship. When taking out a rope (as for mooring in the Suez Canal), the best plan is to make a coil in the boat and then pay it out when pulling away.

Boats are carried on davits by means of which they are swung "outboard" for lowering, or "inboard" for stowage. When it is impossible to carry all a ship's boats on davits, some are stowed on board on skids or chocks, and, when required for use, are got out by means of derricks, or by davits from which other boats have been

lowered into the water. There are a number of patent davits and lowering-gear appliances. A young Officer should lose no time in making himself thoroughly familiar with the working of all such patents employed on his ship, as the usefulness of these contrivances depends altogether on their intelligent and correct manipulation.

Sculling is a very useful accomplishment. It is the propelling



FIG. 1.—A BOAT STOWED FOR SEA.

of a boat by means of one oar placed over the stern (preferably in a rowlock), and worked alternately, first one way and then the other, angling the blade of the oar each time.

THE MARINER'S COMPASS.

The Mariner's Compass is the most important instrument on board ship. Its first use is to direct the ship's course; and its second to take bearings, of which there are two kinds: first, celestial bearings of the sun, moon, stars, and planets, which are taken for the purpose of determining the compass error; and second, terrestrial bearings of points of land, lighthouses, lightships, buoys, &c., for the purpose of ascertaining the position of the ship by means of cross bearings.

The card, which is extremely light (about 180 grains), is supported on a steel pin working in a jewelled cap. It carries six or eight

magnetised needles, which, under the influence of the earth's magnetism, cause it to take up a N. and S. direction. This arrangement is carried in a brass or copper glass-covered bowl suspended



FIG. 2.—MARINER'S COMPASS.*

in gymbals (as the supports are called) which, to prevent jar, are supported by springs. The whole apparatus is contained in a teak case called the binnacle. The binnacle occupies the most convenient position on deck exactly in a fore-and-aft line.

* I am indebted to the late Lord Kelvin for the loan of this block. It is a figure of his well-known compass card.

A vertical line—called the lubber's line—is painted on the fore parts on the inside of the compass bowl. Its purpose is to guide the helmsman to steer correctly to a degree. A brass cover (Fig. 4) on the top of the binnacle carries the lamp which illuminates the compass at night.

There are four principal quarters or divisions of the compass card—corresponding to the Cardinal points, North, South, East and West. These are subdivided into thirty-two equal parts called "points"; the intervals between these points are further subdivided into half and quarter points. Each quadrant, again, is divided into $90^{\circ} - 0^{\circ}$ at N. and S. and 90° at E. and W. In learning the compass it is well to remember that N. and S. are more important points than E. and W., hence the octants are: N.E., N.W., S.E., S.W. Again, the intermediate points are N. by E., N.N.E., N.E. by N., N.E., N.E. by E., E.N.E., E. by N., E., and so for the other quadrants.

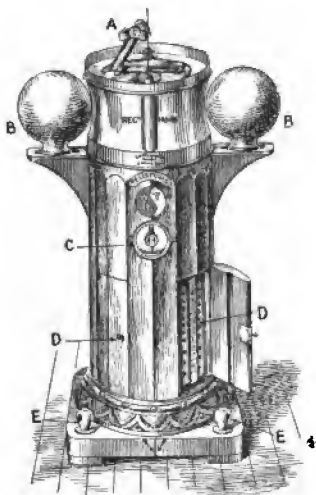


FIG. 3.
LORD KELVIN'S COMPASS.

For the purpose of taking bearings, an apparatus known as an Azimuth Vane, A, rests on a pivot over the compass bowl, on top of the glass. It turns freely in all directions, and is fitted with a prism which reflects an object into the eye of the observer, and with a magnifying glass by which to read the bearings in degrees on the edge of the compass card. The shadow pin, which is upright in the centre, is sometimes useful in taking bearings of the sun.

C. The clinometer, shows the heel of the ship.

E. Screws, which secure the binnacle to the deck.

Fig. 4. Brass top of binnacle, for covering the compass. A plain transparent card may be fitted in the top of this cover (the W.-B. Course and Bearing Indicator, A, Fig. 4), by which to take rough bearings at night-time. Lamps for use at night-time are carried on the sides.

* Some cards are divided for 0° at N. to 360° , an arrangement which, if universally adopted, would very much simplify matters.

B. Soft iron balls, which rest on brackets fitted to the compass for the purpose of correcting the quadrantal deviation.

D. Magnets, placed athwart ships and fore and aft in horizontal holes, so that they can be raised or lowered, and locked up. Their object, together with the Flinder's bar (made up of segments of soft iron, and contained in a brass cylindrical case placed, generally,

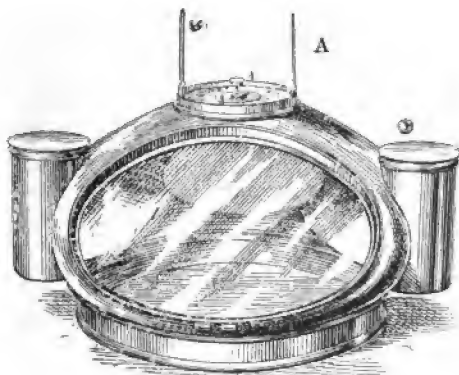


FIG. 4.—TOP OF COMPASS.

in a vertical position on the fore part of the binnacle), is to correct the semicircular deviation.

A brass can placed under the centre of the compass bowl contains a magnet for correcting the heeling error; the chain attached enables its distance to be regulated from the needles.*

MARLINE-SPIKE.

The Marline-spike is a particularly useful instrument on board ship. It is a long, pointed piece of steel, with an eye in the end, to which a lanyard is fitted. To keep the spike from banging about when it is being taken aloft, one should put the lanyard round one's neck, and half hitch it over the point of the spike. No instrument or grease-pot should be used aloft that has not a lanyard attached to it.

* For many other particulars see "The Compass: Historical, Theoretical, Practical," by D. Wilson-Barker. Paper 19, Shipmasters' Society of London; also "Navigation" of this series.

BELAYING-PINS AND CLEATS.

For the purpose of securing or belaying the ends of ropes on deck, "belaying-pins" and "cleats" are used, and the rope is secured to them by twisting and crossing the parts round them, taking care not to take jamming turns. Fig. 5 represents the right way (on left cleat) and wrong way (on right cleat) of belaying a rope

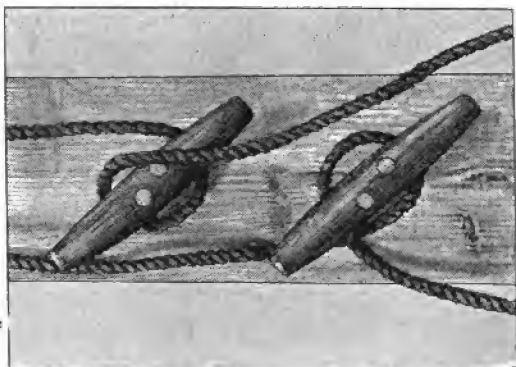


FIG. 5.

RIGHT AND WRONG WAY OF BELAYING A ROPE.

rope. A hitching turn should never be taken, unless with a rope—such as a boat's fall—that is likely to remain some time untouched.

Pieces of wood holding a number of pins, and fastened to the ship's side, or elsewhere, are called *fife rails*.

WATCHES AND TIME.

The duties on board ship are carried on by dividing the ship's company into watches of four hours each, half the ship's company being on duty, day and night. Practically every one has four hours on duty and four hours off. To avoid the time on duty always falling at the same hour, the time between 4 P.M. and 8 P.M. is divided into two watches—4 to 6 and 6 to 8—called the "dog watches." Three watches are sometimes kept at sea in the large liners. The *first* watch is from 8 P.M. to midnight, the *middle* watch from midnight to 4 A.M., the *morning* watch from 4 A.M. to 8 A.M.

Every half-hour is announced by striking the bell (which is found

in every ship, and which should not be less than eight inches in size) as follows :

0.30 A.M.	}	1 bell.	1.0 A.M.	}	2 bells.
4.30 A.M.			5.0 A.M.		
8.30 A.M.			9.0 A.M.		
0.30 P.M.			1.0 P.M.		
4.30 P.M.			5.0 P.M.		
6.30 P.M.*			7.0 P.M.*		
8.30 P.M.			9.0 P.M.		
1.30 A.M.	}	3 bells.	2.0 A.M.	}	4 bells.
5.30 A.M.			6.0 A.M.		
9.30 A.M.			10.0 A.M.		
1.30 P.M.			2.0 P.M.		
5.30 P.M.			6.0 P.M.*		
7.30 P.M.*			10.0 P.M.		
9.30 P.M.					
2.30 A.M.	}	5 bells.	3.0 A.M.	}	6 bells.
6.30 A.M.			7.0 A.M.		
10.30 A.M.			11.0 A.M.		
2.20 P.M.			3.0 P.M.		
10.30 P.M.			11.0 P.M.		
3.30 A.M.	}	7 bells.	4.0 A.M.	}	8 bells.
7.30 A.M.†			8.0 A.M.		
11.30 A.M.			Noon		
3.30 P.M.			4.0 P.M.		
11.30 P.M.			8.0 P.M.		
			Midnight		

The bells should be struck punctually, and in twos, thus 4 bells is 1, 2, sharply, then slight pause ; 3, 4, and so on.

When at anchor, or alongside a wharf, a night watch—anchor watch—is usually kept by “one hand.” If lying out in a stream, an officer also keeps watch. It is his duty to see that the anchor light is kept properly trimmed, and he must make sure, by means of angles or bearings, that the ship maintains its position.

* Dog watches.

† This 7 bells is often struck at 7.20 A.M., so that the relieving watch can get breakfast before going on duty.

PART II

ROPES, KNOTS, SPLICING, ETC.

Knots, Bends, and Hitches—Splicing and Netting—To Worm, Parcel and Serve—Masts and Rigging—Fittings of Yards, Gaffs, &c.

ROPES.

UNTIL quite recently all ropes were made of vegetable fibre, which was teased out, and spun up into suitable form by hand or machine ; but since the introduction of iron, and particularly of mild steel, rope made of this latter material is rapidly superseding all others, even for the running gear. The vegetable fibre ropes are made of hemp, manilla, or coir. The fibres are first spun into yarns, the yarns are twisted into strands, and the strands into the various forms of rope such as :

Hawser-laid rope made up of three or four strands, twisted up from left to right. If the rope consists of four strands, it has a small strand as a heart.

Cable-laid rope, which is constructed by laying up three hawser-laid ropes from right to left.

Coir rope is made from the fibres of the cocoa-nut husk, and, because it floats, it is very useful as a laying-out line, as a guess-warp, or for attaching to a life-buoy.

Wire rope of the best class is composed of six strands ; in the centre of each of these strands there is a hemp heart ; the hearts make the wire more flexible.

Ropes are measured by their circumference.

Wire ropes are made in various lengths, other ropes are generally made in lengths of about 112 fathoms. Hemp ropes are usually tarred ; Manila ropes are sometimes left white ; at other times they also are tarred.

Ratline stuff.—This is composed of 18 or 21 thread (18 or 21 yarns) and is the smallest rope made ; below that there are various kinds of *line* known as amberline, cod line, marline, and spun-yarn (3 and 2 stranded).

Warps and hawsers are very large ropes (generally cable laid), used for towing and securing ships to piers and wharves. These are now almost entirely replaced by wire hawsers, which are much stronger and more handy.

Coiling ropes.—In order to avoid putting in turns, ropes should be coiled with their lay. When a rope is coiled down and turned over for "running," care must be taken to turn the coil over against the lay, so taking out half a turn, otherwise, if suddenly let go as in the case of t'gallant halliards, the rope will probably jam. A rope is said to be "flaked down" when it is coiled on its end, each turn overlapping. It ensures quick running, and is very useful in the case of halliards, which may have to be let go in a hurry for a squall.

When opening a coil of rope for use, a good plan is to turn the coil end down, bringing it up, for uncoiling, through the centre of the coil, then lead it along the deck for stretching. If this plan be carefully followed a new rope free of turns may be rove off without difficulty.

KNOTS.

A knot is formed either by twisting the ends of two ropes together, so as to secure one to the other, or by opening out the strands of one, and forming them into various devices; of the former we have in Plate III., (1) Reef knot; (2) Rope-yarn knot; (3) Turk's head; (4) Figure-of-eight knot; of the latter, in Plate III., (5-6) Matthew Walker knot; and in Plate IV., (1) Shroud knot; (2) Single-wall knot; (3) Double-wall knot; (4) Single wall and crown; (5) Double wall and crown; (6) Stopper knot.

Plates III. and IV. will illustrate the formation of these knots better than any description. There are many other fancy forms of knots, but they are not mentioned here because of their unimportance for practical purposes.

Bends and hitches are varieties of knots used in tying ropes together, or in attaching a rope to anything else. They are illustrated in Plate V.

Clove hitch is used for rattling down rigging.

Round turn and two half hitches are used for securing a rope to a stanchion or anything else; so that it will not jam, and also for sending a sail aloft.

Timber hitch is used to tow or lift a piece of timber, or to send down a sail from aloft.

Rolling hitch is used to attach a rope to another, so that it will not slip when hauled on.

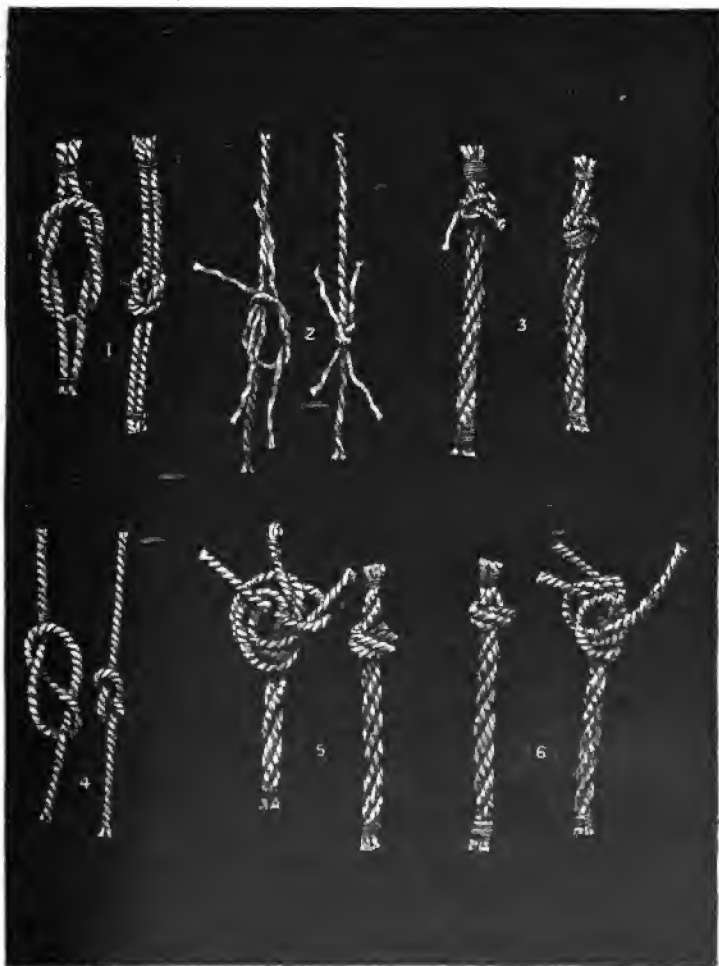


PLATE III.—KNOTS.

- | | |
|----------------------|--------------------------|
| 1. Reef knot. | 3. Turk's head. |
| 2. Rope-yarn knot. | 4. Figure-of-eight knot. |
| 5-6. Matthew Walker. | |

B

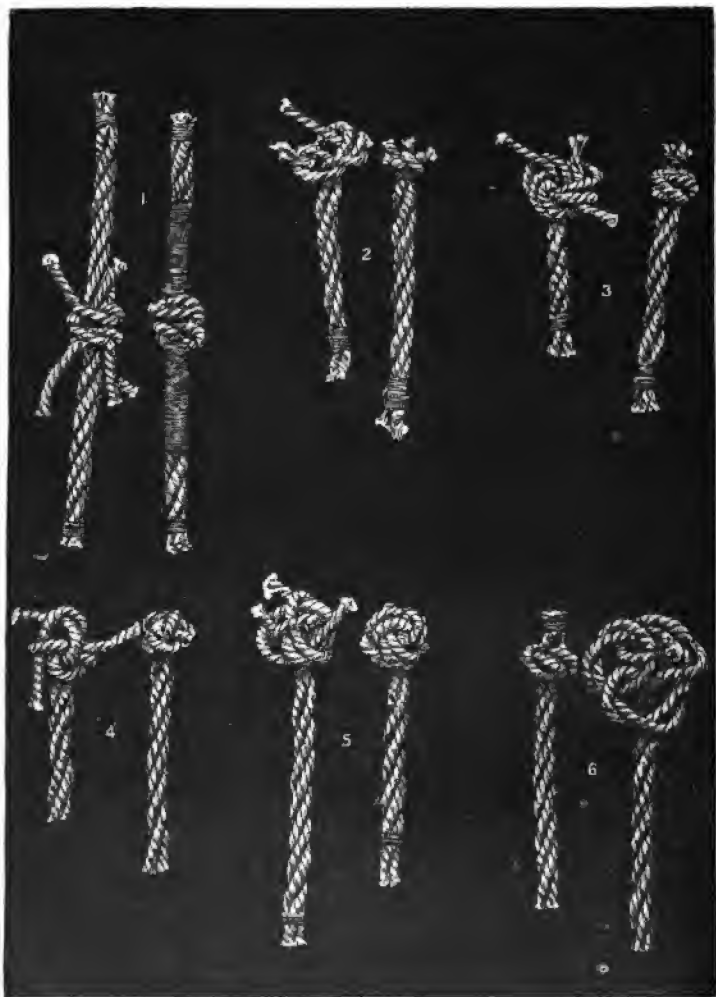


PLATE IV.—KNOTS.

1. Shroud knot.
2. Single wall.
3. Double wall.

4. Single wall and crown.
5. Double wall and crown.
6. Stopper knot.

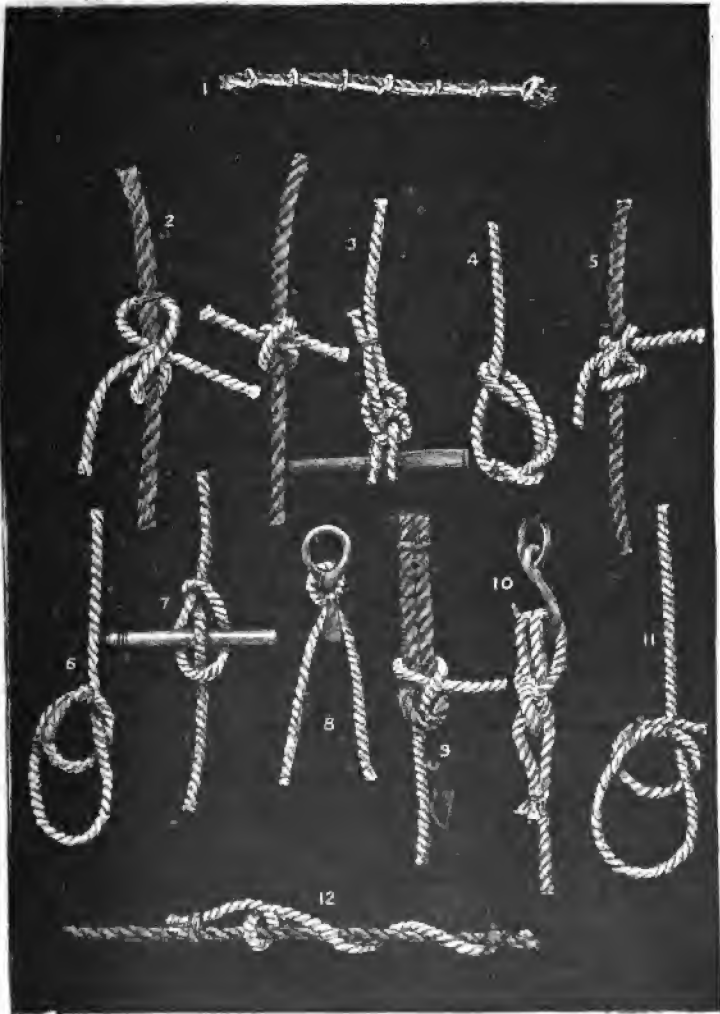


PLATE V.—HITCHES, BENDS, AND CLINCHES.

1. Marline hitch.
2. Clove hitch.
3. Round turn and two half hitches.
4. Timber hitch.
5. Rolling hitch.
6. Inside clinch.

7. Marline-spike hitch.
8. Blackwall hitch.
9. Sheet bend.
10. Cat's-paw.
11. Outside clinch.
12. Stopper.

Marline-spike hitch is used for heaving, making seizings and such like, tight.

Blackwall hitch, for attaching a rope quickly to the hook of a block. Can be doubled.

Marline hitch is used for marling down, parcelling on a rope, or for making a selvagee strop.

Sheet bend, to make a rope fast to the bight of another.

Cat's-paw, for putting on the hook of a block.

Stopper.—A short piece of softened rope, which is used as a preventer, on a rope with a heavy load. It is hitched round it, the end is laid along the lay, and held by the hand, in the pauses between the haulings.

Clinch, inside or out, according to the way in which the end is seized. It is used in cases where the rope has to be let go ; also when it is necessary to avoid all risk of jamming as in attaching buntlines to sails.

Selvagee strop.—A strop is often used to attach a block to rigging, or to a rope, such as a tops'l sheet. It is made of good yarns laid round in the form of a ring, and marled down with yarns. It is then twisted round the rope to be hauled on, and the hook of the block is placed into the bight ends.

Bowline is used for sending a man aloft, for making a pair of slings, for bending two ropes together, and for many other purposes. If made on the bight (**bowline on the bight**), it is useful for lowering an injured man from aloft ; if fitted as a **running bowline**, for throwing over anything out of reach.

Sheepshank is useful for shortening up a rope.

Slings.—A sling is a large strop ; it is used for hoisting in casks, cases, bales of goods, or, in fact, anything. They are generally made of Manila. The two parts are passed under the package to be lifted ; then one bight (which hooks on to the hook of the tackle) is rove through the other bight and tightened up. As a makeshift a bowline can be turned into a sling at a moment's notice.

Parbuckle.—A parbuckle can be used to roll a cask up an incline ; to raise any weight, such as a mast, up a ship's side ; or to transfer a package from a boat on to a wharf, where no other lifting appliances are available. It consists of two ropes ; the ends are made fast at the place to which the weight is to be raised, and the loose ends passed under the package, or other weight, and brought up to the same place. By hauling on these ends, the weight can be rolled or slid up the incline, or skids fitted for that purpose.

Plate VI. illustrates the bends and slings.

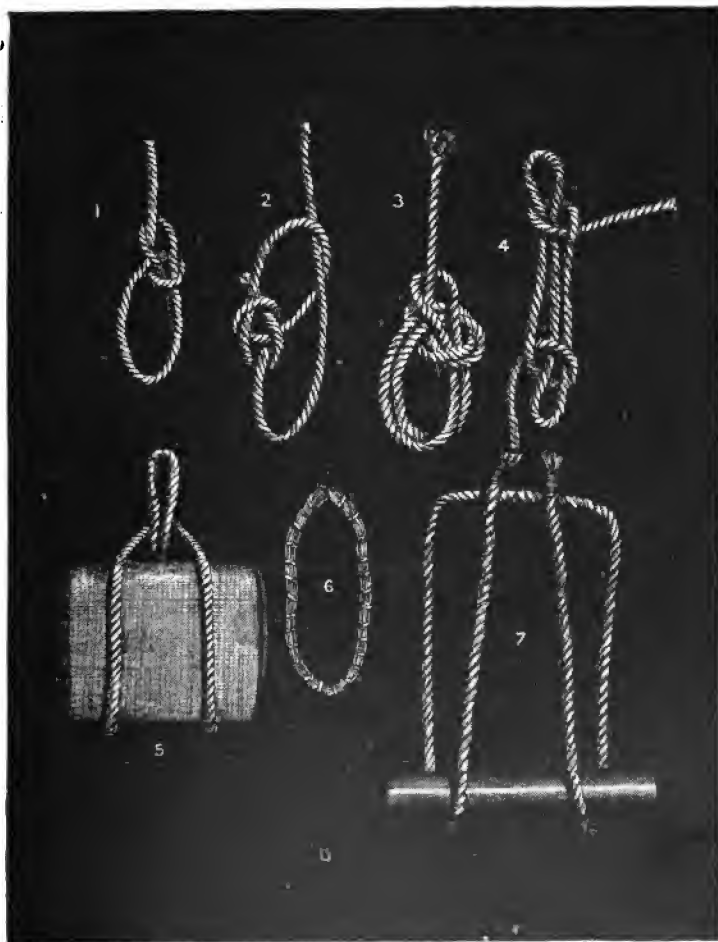


PLATE VI.—BENDS AND SLINGS.

- | | |
|--------------------------|--------------------|
| 1. Bowline. | 4. Sheepshank. |
| 2. Running bowline. | 5. Slings. |
| 3. Bowline on the bight. | 6. Selvagee strop. |
| 7. Parbuckle. | |



PLATE VIA.—CARGO SLINGS.

- | | |
|----------------------------|-------------------------|
| 1. Slinging a cask on end. | 3. Can hooks on a cask. |
| 2. Slinging casks. | 4. Slinging a case. |
| { 5. Slinging a bale. | |

SPLICING.*

To join two pieces of rope together, without appreciably increasing their diameter, an operation called "splicing" is gone through. There are various kinds of splices, viz., short splice, long splice, eye splice, cut splice, and horse-shoe splice. (Plate VII.) The principle in each consists of interlacing the strands, thinning them out, and tapering, so that the increase in diameter is only slight. In long splicing, there should be no increase in diameter.

In the short splice, the two ends of the ropes are unlaied for a short distance, and the strands of each one brought together so that they interlock or marry; the centre ones are first tucked under one another, and then all the others. After the first tuck of each pair of strands, the strands are halved, and so on, two tuckings from each being ample. In a long splice each succeeding strand is carried much farther back, so that the tucking for each comes wide apart. In cable-laid ropes, the process has to be carried out for every strand. Care should always be taken not to waste rope in the splicing.

In an eye splice, the rope is opened out, and turned over, so as to leave an eye the required size; then the ends are tucked, the middle strand first; then the strand on the left, which has a turn or two taken out of it so as to lie flat (the bight of the eye being held next the splicer), and the strand on the right last. This right strand should tighten up the first tucking.

Plate VII. will explain the cut and horse-shoe splices.

Splicing wire rope.—As has been stated, there is a hemp heart in each strand, and a heart the size of the strands through the centre of all. In making a long splice, care must be taken to unlay the strands without taking the turn out. It is well to unlay them in pairs. The unlaying of each pair can be continued when they are married. At least 3 feet will be required for each strand in splicing a fair-sized rope; this will mean 18 feet in all. This rope is first put together as if splicing an ordinary three-stranded rope. Take one pair of strands, unlay them singly, and lay them up clear of each other for splicing, till these six pairs of ends are at suitable distances apart. Thrust a spike right through the heart of the rope at one end of the splice, leaving three strands to either side of the spike. Pull out the bight of the hemp heart with another spike, cut it a few inches to either side, and work the two ends of the wire rope into its place. This is easily done by moving the first spike about in its place. Cut the end of the strand you are working

* A splice is about $\frac{1}{3}$ weaker than the rope itself.

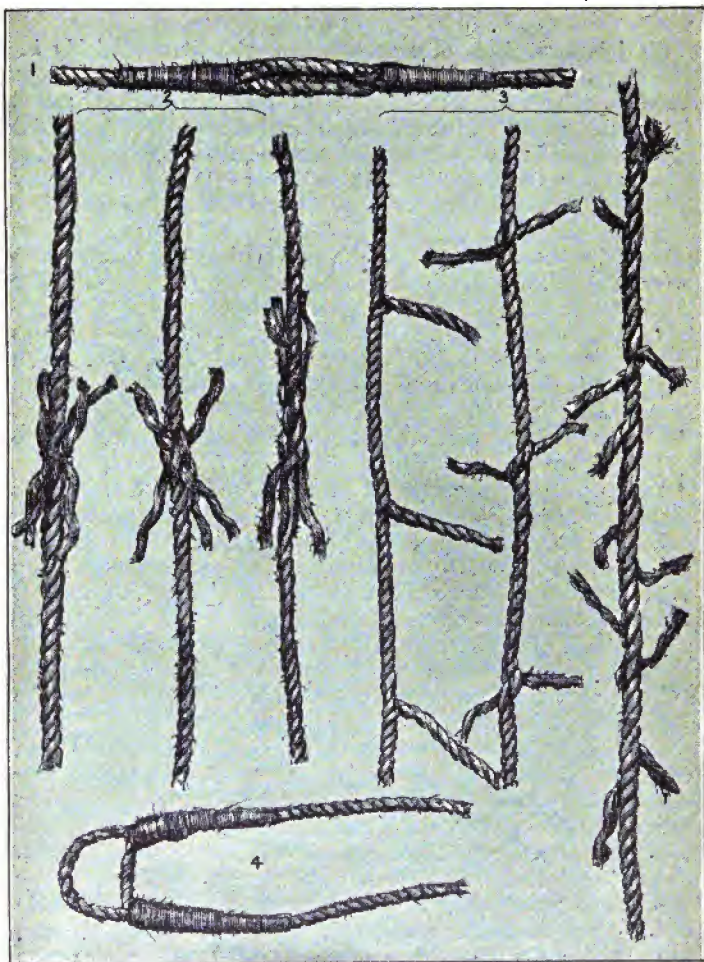


PLATE VII.—SPICES.

1. Cut splice.
2. Short splice.

3. Long splice.
4. Horse-shoe splice.



PLATE VIII.—STAGES OF SPLICING.

- | | | | | | | |
|---------------------|--|-----------------------|--|----------------|--|----------------|
| 1. Unlaid in pairs. | \| | 2. Unlaid in singles. | \| | 3. First tuck. | \| | 4. Final tuck. |
|---------------------|--|-----------------------|--|----------------|--|----------------|

on, and butt it against the end of the heart in the centre. Proceed in like manner with all the strands: the parts will then jam in tightly together, and look very neat. Plate VIII. shows the splice in various stages. In the case of a hawser, the ends of the strands

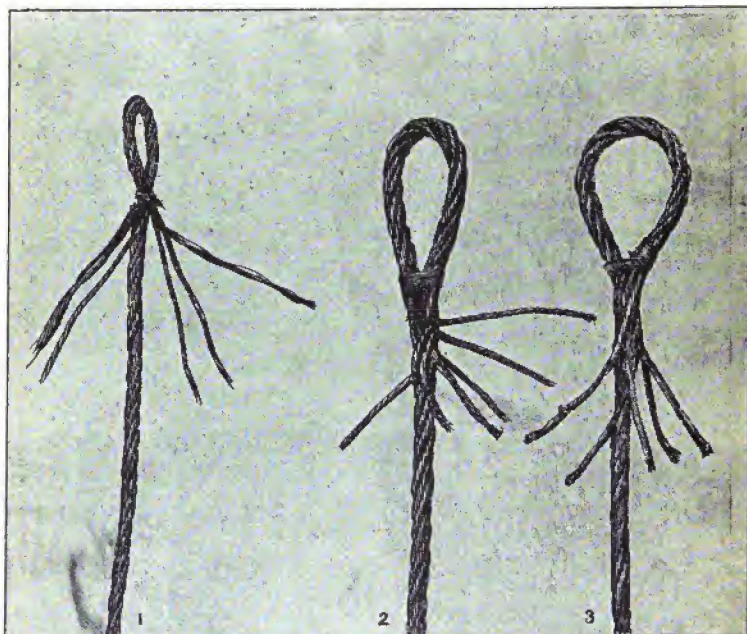


PLATE IX.—EYE SPLICE.

may be tucked once to insure safety, though this precaution is scarcely necessary.

In making an eye splice, there are various ways of tucking the ends, but only one will be noticed here. When the size of the eye is determined on, fix a light seizing on the wire, about two feet from the end (Plate IX. 1), unlay the ends to this seizing, and bend the wire to the shape of eye required. Hang this bight up with a piece of line, so that the splicing part comes about level with the chest. Place the main part of wire to the left; divide the unlayed strands so that three are on the left, and three on the right of the main rope; proceed to tuck the first end on left under two strands of the main

wire, and so on with the others (as shown in Plate IX. 2), placing each of these, however, under one strand only (Plate IX. 3).

Take care to enter all in one way, that they may come out in their proper lay. Haul the strands fairly tight, and hammer them into their places, leaving a small space in the neck of the splice. Then tuck the strands twice under one strand only, taking care not to make the tucks too short, or a lumpy splice will be the result ; now halve the strands, and tuck once.

Remember that the neatness of a splice depends a good deal upon the manipulating and humouring of the strands.

When the ends are cut off, a judicious application of the spike and hammer will finish the splice, which should then be parcelled with oiled canvas, and neatly served over. Amber line should be used for this purpose for large ropes.

Notes on wire ropes.*—The diameter of barrels and sheaves given in the rope tables is the extreme minimum for slow speeds. Better working results, in all cases, will be obtained by increasing the diameter of sheaves or barrels.

Running ropes should always be ungalvanised.

Never work a rope with a riding part, or allow it to overlap.

A kink cannot be taken out of a rope by strain, only by throwing the " turn " out.

Never reeve a rope direct from the coil, put it on a wheel or reel and run it off.

Always keep your ropes well oiled or greased ; any lubricant will do as long as it does not contain acid or alkali.

The sign of an overloaded rope is excessive stretching.

Stock ropes must be kept free from moisture, and in a dry place.

* Compiled by Messrs. Bullivant & Co., Ltd.

BULLIVANTS' RIGGING SCREWS.

FIG. 6.
Straining Screw.

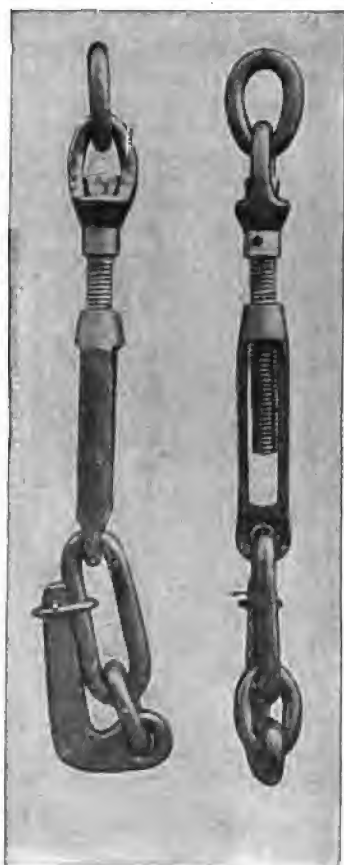


FIG. 7.
**A Screw for setting up Rigging,
fitted with Slip Hook.**

BULLIVANTS' ROPE END FITTINGS.



FIG. 8.

Comparative Size of Thimble and Shackle required for Wire and Hemp Hawasers of equivalent strength.



FIG. 9.

- | | |
|---|--|
| <p>1. Shunting Hook, suitable for railway work.</p> <p>2. Swivel Hook, suitable for general [work.]</p> | <p>3. A Spring Hook.</p> <p>4. A Cargo Hook.</p> <p>5. A Liverpool Cargo Hook.</p> |
|---|--|



FIG. 10.—SWIVEL.

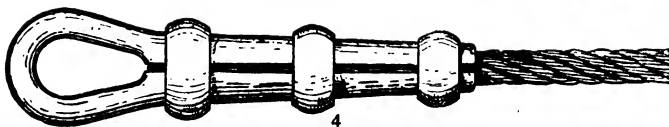
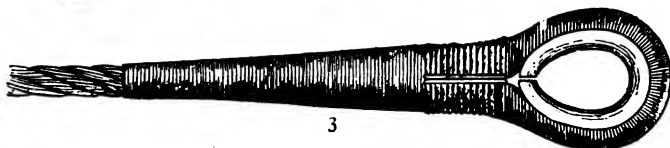
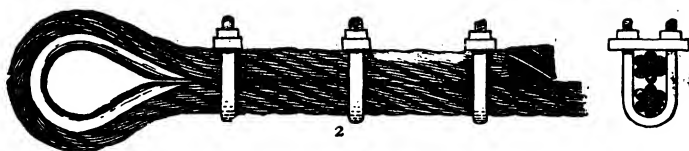
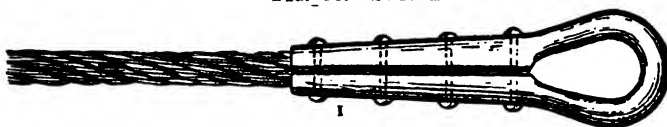


PLATE X. (BULLIVANTS').

1. Shoe with Rivets.
2. Clips.
3. Splice with Thimble seized in.

4. Shoe with Driven Rings.
5. Socket.
6. Thimble spliced in close.

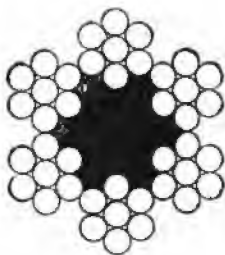
BULLIVANTS' STEEL WIRE ROPES (GALV.).

FLEXIBLE STEEL WIRE ROPE. 6 Strands, each 12 Wires.				EXTRA FLEXIBLE STEEL WIRE ROPE. 6 Strands, each 24 Wires.		SPECIAL EXTRA FLEXIBLE STEEL WIRE ROPE. 6 Strands, each 37 Wires.	
Size Circumference.	Weight per Fathom. Approx.	Guaranteed Breaking Strain.	Diameter of Barrel or Sheave round which it may be at a slow speed worked.	Weight per Fathom. Approx.	Guaranteed Breaking Strain.	Weight per Fathom. Approx.	Guaranteed Breaking Strain.
Inches.	Lbs.	Tons.	Inches.	Lbs.	Tons.	Lbs.	Tons.
1	.63	1.75	6	.88	2.95	1.0	...
1 1/4	1.05	2.5	7 1/2	1.31	4.45	1.56	...
1 1/2	1.44	4.0	9	1.88	6.7	2.0	7.25
1 3/4	2.0	5.5	10 1/2	2.5	8.75	2.88	10.0
2	2.44	7.0	12	3.5	11.85	4.0	13.0
2 1/4	3.37	9.0	13 1/2	4.5	14.6	4.88	15.75
2 1/2	4.19	12.0	15	5.44	18.55	5.88	19.75
2 3/4	5.25	15.0	16 1/2	6.25	21.95	7.0	24.0
3	6.25	18.0	18	7.63	25.7	8.25	29.0
3 1/4	7.06	22.0	19 1/2	9.37	30.8	10.38	33.5
3 1/2	8.25	26.0	21	10.75	35.2	11.5	38.5
3 3/4	9.87	29.0	22 1/2	12.19	41.1	13.38	44.5
4	11.25	33.0	24	13.62	46.3	15.25	51.0
4 1/4	12.35	36.0	25 1/2	15.69	52.9	17.12	58.0
4 1/2	13.44	39.0	27	17.75	58.6	19.0	63.5
4 3/4	...	...	...	19.88	66.4	21.69	71.25
5	...	...	...	22.5	74.2	24.38	79.25
5 1/4	...	...	...	23.25	82.88	27.69	87.75
5 1/2	...	...	...	24.5	91.55	31.0	96.75
5 3/4	...	...	...	...	...	33.75	103.75
6	...	...	...	...	...	36.5	113.75

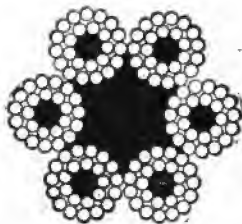
In these Flexible Rope Tables, the wire is calculated as taking a breaking strain of 90 tons to the square inch; ropes made of wire which is calculated above that will take a proportionately higher breaking strain.

VARIOUS "MAKES" OF WIRE ROPE.

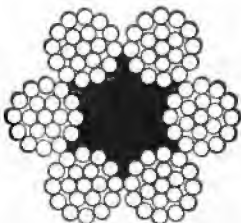
Wire ropes, where flexibility is not necessary, are usually made 6 strands each of 7 wires, i.e., each strand is made of 6 wires covering 1 soft wire. In many cases, however, the sheaves or winding drums are too small in diameter to allow such a make of rope to be worked, flexibility is therefore obtained in the rope by increasing the number of wires, of which the following are the usual types :



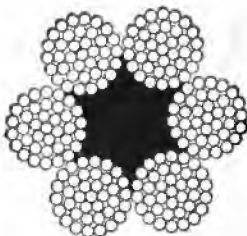
Laid Rope.—This rope is made 6 strands of 7 wires; it is the class of rope usually used for hauling ropes where the size of barrel and sheave will permit. It is also the make of rope usually used for standing rigging, and is such as is required by Lloyd's regulations.



Extra Flexible Steel Wire Rope.—Made of 6 strands each of 24 wires.



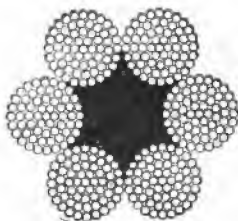
Formed Rope.—This is made 6 strands of 19 wires. In larger sizes this make of rope is used for standing rigging on vessels. In smaller sizes it is sometimes used for running rigging, and it is the usual make of rope for trawl warps.



Special Extra Flexible Steel Wire Rope.—Made of 6 strands each of 37 wires.



Flexible Steel Wire Rope.—Made 6 strands each of 12 wires, with hemp heart and hemp centre in each strand. This is the usual make of Flexible Steel Wire Rope, $\frac{1}{4}$ in. circ. and smaller; used for hawsers, running lifts, hoists, &c.



Special Extra Flexible Steel Wire Rope.—Rope made of 6 strands each of 61 wires. This is the make of rope usually adopted for large ropes—say over 10 in. circ.—and which are largely used for shipway and salvage purposes.

PLATE XI. (BULLIVANT'S').

BULLIVANTS' GALVANISED FLEXIBLE STEEL WIRE HAWSERS AND CABLES COMPARED WITH HEMP AND CHAIN.

FLEXIBLE STEEL WIRE HAWSERS AND CABLES.				CHAIN CABLE.			SHORT LINK CHAIN.			TARRED HEMP ROPE.		
Size Circumference.	Weight per Fathom.	Guaranteed Breaking Strain.	Diameter of Barrel or Sheaves round which it may be worked.	Size.	Weight per Fathom.	Proof Strain.	Breaking Strain.	Size.	Proof Strain.	Breaking Strain.	Weight per Fathom.	Size.
Inches.	Lbs.	Tons.	Inches.	Inches.	Lbs.	Tons.	Tons.	Inches.	Tons.	Tons.	Lbs.	Inches.
12	115	320	72	2 1/2	280	96 1/2	134 1/2	...	...	...	146	25
11	97	270	66	2 1/4	256	85 1/2	120 1/2	...	...	...	134	24
10	80	220	60	2 1/8	231	76 1/2	107 1/2	...	...	...	123	23
9	65	180	54	1 7/8	204	67 1/2	94 1/2	...	...	...	106	21
8	53	150	48	1 7/8	166	55 1/2	77 1/2	...	...	...	84	19
7 1/2	47	130	45	1 7/8	143	47 1/2	66 1/2	...	...	...	72	17
7	41	116	42	1 7/8	112	37 1/2	55 1/2	...	...	...	60	15
6 1/2	37	102	39	1 7/8	68	24 1/2	34 1/2	...	...	...	56	13
6	33	83	36	1 7/8	54	18	27	...	...	...	50	12
5 1/2	28	74	33	1 7/8	48	15 1/2	23 1/2	...	...	...	34	11
5	23 1/2	64	30	1 7/8	35	11 1/2	17 1/2	...	...	...	29	10
4 1/2	15	39	27	1 7/8	30	8 1/2	15 1/2	...	...	...	24 1/2	9
4	12	33	24	1 7/8	25	7	12 1/2	...	...	...	20	8 1/2
3 1/2	9	20	21	1 7/8	21	5 1/2	9 1/2	...	...	...	16 1/2	8
3 1/4	8	22	18 1/2	1 7/8	18	4 1/2	7 1/2	...	...	...	14	7 1/2
3	7	18	18	1 7/8	16 1/2	4	6 1/2	...	...	...	13 1/2	7
2 1/2	5 1/2	15	15	1 7/8	15	3 1/2	5 1/2	...	...	...	11 1/2	6 1/2
2 1/4	4 1/2	12	15	1 7/8	14 1/2	3	4 1/2	...	...	...	10 1/2	6
2 1/8	3 1/2	9	12 1/2	1 7/8	12	2 1/2	3 1/2	...	...	...	9	5 1/2
2	3	7	12	1 7/8	10 1/2	2	2 1/2	...	...	...	8 1/2	5
1 1/2	2 1/2	5 1/2	9	1 7/8	9	1 1/2	2 1/2	...	...	...	7 1/2	4 1/2
1 1/4	2	4 1/2	9	1 7/8	8 1/2	1 1/2	2 1/2	...	...	...	6 1/2	4
1 1/8	1 1/2	4	7 1/2	1 7/8	7 1/2	1 1/2	2 1/2	...	...	...	5 1/2	3 1/2
1 1/8	1 1/2	4	6	1 7/8	7 1/2	1 1/2	2 1/2	...	...	...	5 1/2	3 1/2
1 1/8	1 1/2	4	6	1 7/8	7 1/2	1 1/2	2 1/2	...	...	...	5 1/2	3 1/2
1 1/8	1 1/2	4	6	1 7/8	7 1/2	1 1/2	2 1/2	...	...	...	5 1/2	3 1/2

NETTING.

Nets are either "made" nets, or "worked" nets. The former can be made on deck, by enclosing a space in the shape desired with wire. To form the mesh, ratline (or other small stuff) is stretched across the enclosure, at proper distances, first in one direction, from A to B, Fig. 11, then in the opposite direction (C to D), care being taken to keep the spaces equal. The crossings are secured with twine seizings.

Another but a weaker method of net-making is to draw the parts into the heart shape, and seize them, as in Fig 11.

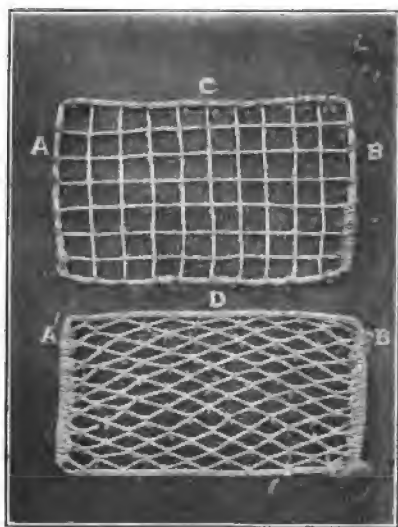


FIG. 11.—NETS.

Worked nets are manufactured by means of needle and mesh, and are made of fine stuff.

Nets are fitted under the jib-boom for the jibs, and over the bowsprit for the stays'ls, to aid the stowage of these sails.

SENNIT.

Sennit is a plaiting of any number of yarns, from three upwards. It may be flat, round, or square in form, the flat form being most adaptable for general use. Sennit is made of yarns. It is used chiefly for chaffing gear, gaskets, &c. In working, the material should be held in the left hand, while the right lays in the plaits.

TO WORM, PARCEL, AND SERVE.

To "worm" a rope, first take some yarn, or a small line, and



FIG. 12.—TO WORM A ROPE.

with it fill up between the lay of the rope to be worked over, working with the lay, so as to level all inequalities (Fig. 12).

To parcel, take some strips of tarred canvas (pieces of old sails or awnings) about $1\frac{1}{2}$ to 2 inches wide, rolled bandage-wise, lay it

over the rope and worming, working up with the lay. Each turn of the canvas should slightly overlay the one that went before (Fig. 13).

To serve.—Work spun yarn (or other small line) over the parcelled rope, in the opposite direction to the lay, using a



FIG. 13.—PARCELLING A ROPE.

serving mallet for the purpose. Unless a patent mallet is used, two operators are required to serve a rope, one to work the mallet, the other to pass the ball of small line (Fig. 14). The operator passing the ball must take care to keep turns out of the line as passed.

Service is chiefly used for covering splices, working on foot-ropes in the wake of the stirrups, in the eyes of rigging, and in many other places. Formerly the rope rigging was, as a rule, served all over ;

as also till quite recently was wire rigging ; but the utility of the operation in the latter case is doubtful, wire rigging is not now



FIG 14.—SERVING A ROPE.

served. Sailors have a little doggerel rhyme, which will help the student's memory. It runs thus :

Worm and parcel with the lay
Turn round and serve the other way.

MASTS AND RIGGING.

Masts are made of wood, iron, or steel. Many steamers, and some other vessels, have wooden masts formed of one piece. Some of the old large sailing ships used masts composed of several longitudinal pieces, known as "built masts." Hollow iron or steel masts, fitted internally with strengthening angles, are now most generally used.

Masts are secured by means of wire ropes, called **rigging**. At a certain distance from the mastheads, strong pieces of wood or iron, called **trestle-trees**, are bolted on in a fore-and-aft direction, and are supported from below by extra flange-pieces, called **hounds**,

and cheeks, bolted on to the masts. On the trestle-trees transverse pieces called **cross-trees** are bolted. The trestle-trees take the weight of the mast above, and the cross-trees make a platform, which is generally covered over on the lower mast forming the Top, and left open on the topmast ; they also form a means of spreading the topmast rigging. The lower rigging is put over the masthead in the following order : the first pair of starboard shrouds, the first pair of port shrouds, the second pair of starboard shrouds, and so on ; and last of all the stay. Many ships have cap shrouds and cap backstays, which shackle on to bolts in the cap, and help to support the mast where the strain of the lower yard comes. Topmasts and spars above are fitted with backstays in addition to shrouds. Spars of iron or wood, called **outriggers**, are fitted to project out from the topmast cross-trees, to assist in spreading and keeping in their place the t'gallant and royal backstays. The lower shrouds and all backstays are set up by means of **dead-eyes**, or screws, which are attached to the frames of the ship, and on a level with the rail of the ship, and the stay, by means of **hearts** and **wire lanyards**. The stay is set up first, then the shrouds and backstays. The foremost shroud of the lower rigging is known as the **swifter**. (See Plate II.)

BOWSPRIT.

In all modern ships, the long bowsprit, jib-boom, and flying jib-boom, with their accessory gear of dolphin striker and whiskers, have been shortened into what is known as the **stump bowsprit**, which is really an integral part of the bow of the vessel. It is securely bolted thereto, and further held in position by means of an iron band, called the **gammoning**, on the inboard end, secured by means of iron stays (called **bobstays**) and shrouds, at the outboard end. The bowsprit is intended for the purpose of setting up on it the fore-t'gallant and royal stays, and also for spreading the head sails, consisting of the foretop-mast stays'l, inner and outer jibs. The forestay and foretop-mast stay are set up to the knightheads ; inner and outer jib stays, t'gallant and royal stays also to the knightheads, after passing through leads on the ends of the bowsprit and jib-boom.

■ The lower masts, topmasts, and bowsprits are now generally made of steel ; the two former are frequently all in one piece.

FITTINGS OF YARDS AND GAFFS.

Yards.—The lower yards are fitted with **trusses** and **truss bands** ; **slings** and **sling bands** ; **tops'l sheet lead bands** ; **yard-arm bands**

for lifts, braces, foot-ropes, and jackstay bands. Sometimes two jackstays are fitted, one for bending the sail to, and the other for holding on to.* The jackstays are rove through bolts in the bands. Eyebolts are fitted either at the yard-arm, or in slings, for clew garnets. The foot-ropes make fast to one of the truss arms amidships, and to an eyebolt at the yard-arm, and are supported in places by stirrups (short pieces of rope attached by one end to the jackstay bolts with seizings, and having an eye at the other end through which the foot-rope is rove). Foot-ropes and stirrups are now generally made of wire, as are also brace pendants and lifts. The slings are made of chain and the truss of iron.

Lower lifts are rove through blocks at the masthead, and are then fitted with tackles which can be slackened up or hove taut on deck. Other lifts shackle to strops or bands fitted to the mastheads, and to eyebolts on the yard-arms. Lower tops'l and lower t'gallant yards are hung from their respective caps by means of a crane (which takes the place of a truss and slings in the lower yard), and their lifts are shackled on some little distance inside the yard-arm, and are unshackled when at sea.

A tub or parrel is fitted on the upper tops'l and other hoisting yards, to facilitate the hoisting and lowering of the yards by means of the tyes and halliards, as the arrangement of ropes and tackles for setting the sails is called, and to keep the yard to the mast.

Wooden masts are kept bright and greased to enable the parrels to work easily up and down.

Braces are fitted with blocks and wire pendants to the yard-arm, a runner being rove through the block. In the case of tops'l and lower yards, all parts, except the standing part of the upper brace, lead to bumpkins at the ship's side, or just inside the ship's rail. Sometimes the standing part of the fore lower tops'l brace seizes on to the mainstay just under the maintop.

Gaffs are sometimes fitted so as to be fixed in position, and are sometimes made to work up and down the mast on an iron jackstay.

In the first case, there is generally a piece of iron called a *goose-neck*, which is jointed and fits into a stationary iron on the mast, just under the top; the free end is held in place to a bolt, on or near the cap, by a chain tye. In the second case, the *goose-neck* fits into a sliding piece of iron called a *shoe*, which works up and down on a jackstay, on the after part of the mast. Underneath the gaff, there is generally another jackstay, to which the sail is

* Becketts are generally fitted on to jackstays through which the arm can be passed for safety when picking up the sail.

attached by means of hanks. When it is necessary to take in the sail, by the downhaul and brails, it is hauled down against the mast, to which it is made fast with gaskets.

There is a goose-neck at the mast, where a spanker boom is fitted, the free end is supported by lifts, and is controlled by sheets.

Gaffs are fitted with vangs to steady them sideways.

WHIPPINGS.

Ordinary Whipping.—In this, several turns are taken with the twine round the end of the rope ; then turns are taken on the bight over the end, which, when hauled tight, jams itself.

Sailmaker's Whipping.—In this, the twine is wound round the rope on its end, for about a dozen turns ; the end is then passed through between each strand, across the seizing, with a needle, so jamming the whole together and making it very compact. The ends of all earings, gaskets, and awning stops should be whipped with this kind of whipping.

West Country Whipping.—Place the middle of the twine against the rope and take turns round the rope with both ends, making a half knot at each half turn, then finish off with a reef knot. It is useful for marking braces, &c.

PART III

GEAR, LEAD, AND LOG, ETC.

Running Gear—Seizings—Lead and Log—Spanish Windlass—Blocks—Tackles and Purchase.

RUNNING GEAR.

Running gear is fitted to sails, to set and take them in. It is called **running** because it is movable, in contradistinction to the fixed gear, or **standing rigging**. The principal running gear are buntlines, and spilling lines, leechlines, slablines, clew garnets and clewlines, tacks and sheets, bowlines, reef-tackles, down-hauls and outhauls, brails and tripping lines, halliards and tyes, and braces.

Buntlines are rove down before the yard, and clinch on to thimbles in the foot of the sail.

Spilling lines often replace buntlines. They run through the bull's-eyes in the foot, and go right round the sail. The buntline or the spilling line is *the* gear for keeping the sail quiet.

Leechlines are often double ; they lead in a similar way to the leech of the sail. In big single t'gallant sails, the leechline goes right round the leech.

A **slabline** is sometimes fitted to the centre of the foot, on the after side of a course, and is attached by a clinch. It is useful, when tacking ship, for tripping up the foot of the mains'l. The clews of sails are hauled up by means of clew garnets, or clewlines, fitted double in courses and lower topsails. They are called clew garnets only in the case of the courses. Above these sails they are clewlines. They are generally fitted to haul the clew of the sail up under the bunt. It is now becoming usual to clew up to the yard-arms.

Courses are set by means of sheets and tacks. A single tack and a double sheet are fitted to each clew. To set the sail properly, a wire or chain pendant is hooked into the weather clew from the

deck ; it is hove down tight by means of a tackle or winch. The single line acts as a lazy tack.

Sheets only are fitted to sails above the courses ; these sheets are of chain, in the wake of the yard, and are led through a sheave at the yard-arm, along the under part of the yard, again through a sheave under the quarter of the yard, and thence on deck.

Bowlines are attached to the weather leech of courses, to haul it well forward, being rove through a lizard fitted on to the bowline bridles.

As the upper topsails and upper t'gallant sails are never clewed up, their clews are secured to the yard-arms by small pieces of chain, or by long shackles.

Clewlines and **buntlines** are led down on deck amidships ; and those of t'gallant sails and royals to the ship's side.

Reef-tackles are fitted to square sails, to haul the leech up to the yard when the sail is to be reefed, to insure the reef earing being hauled quite home, and that the points may be tied properly.

Fore-and-aft sails, such as trysails, spankers, and drivers, are fitted with **downhauls** and **outhauls**, for hauling the head of the sail up and down the gaff ; and with **brails** for taking the sail in. The downhaul and the outhaul are seized to the peak thimble ; the brails are middled, and the bights seized on the after leech of the sail, so that a part of the brail is on either side of the sail ; each part is led to the deck through a block lashed to the jackstay on the mast.

In addition to halliards and downhauls, stays'ls (other than the f.t. stays'l) are often fitted with **tripping lines**, useful for lifting the clews over the stays on change of tack. Jibs and head-stays'ls are fitted with a sheet on each side.* Staysail and jib sheets are fitted with a wire pendant, through the block of which a whip is rove. Other fore-and-aft sails have only one sheet, shifted from side to side. When a sail is set, the buntlines, leechlines, spilling lines, and downhauls (upper yards) should be carefully overhauled and stopped with twine, and gaskets should be made up and stopped to the jackstay, to prevent the sails being chafed.

Sails are generally carried as long as is prudent, and as there is less danger of their splitting when on the stretch as set, than when slack and banging about, the gear should be fitted so as to snug up the sail as quickly as possible. In this operation the gear must be carefully placed. Useful assistance may be given by the helm, or by trimming the yard.

* The weather sheet should be overhauled and stopped on the stay to prevent chafe.

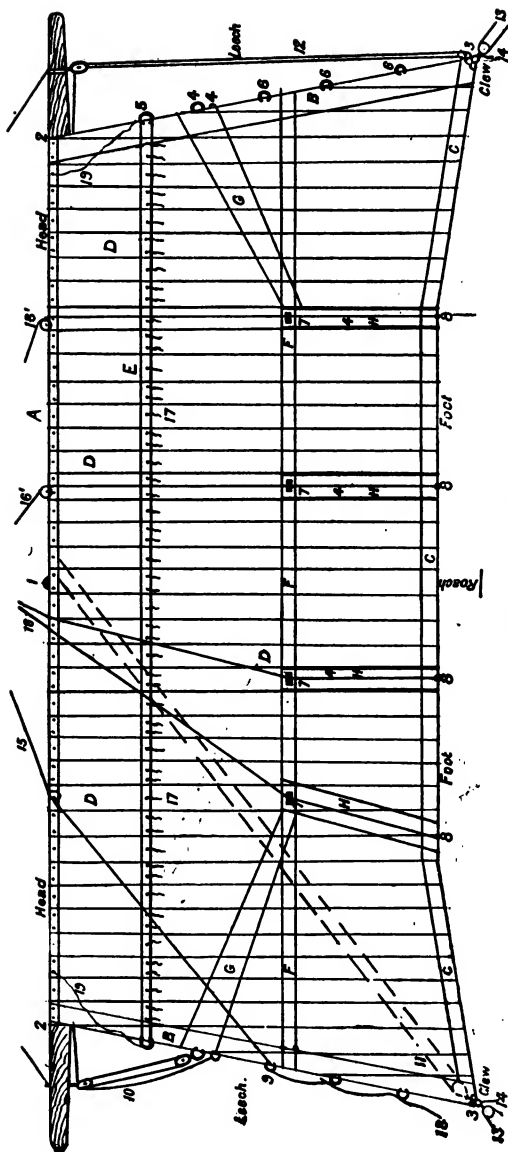


FIG 15.—MAINSAIL. FORE PART.

- | | | | |
|--|--------------------------------------|---|------------------------|
| 1. Bunt stop. | 9. Bowline bridges. | 16. Buntline. | B. Leech lining. |
| 2. Head earring. | 10. Reef tackle. | 16'. Buntline as fitted when sail clews up to yard-arm. | C. Foot band. |
| 3. Clew spectacle. | 11. Clew garnet on aft side of sail. | 17. Reef points. | D. Cloths in the sail. |
| 4. Reef tackle cringles. | 12. Clew garnet to yard-arm. | 18. Bowline lizard. | E. Reef band. |
| 5. Reef-earring cringle. | 13. Sheet. | 19. Reef earring. | F. Belly band. |
| 6. Bowline bridle cringles. | 14. Tack. | A. Head tabling 4½ in. wide. | G. Reef tackle band. |
| 7. Bull's-eyes. | 15. Leechline | | H. Buntline cloths. |
| 8. Buntline cringle, or holes with thimbles. | | | |

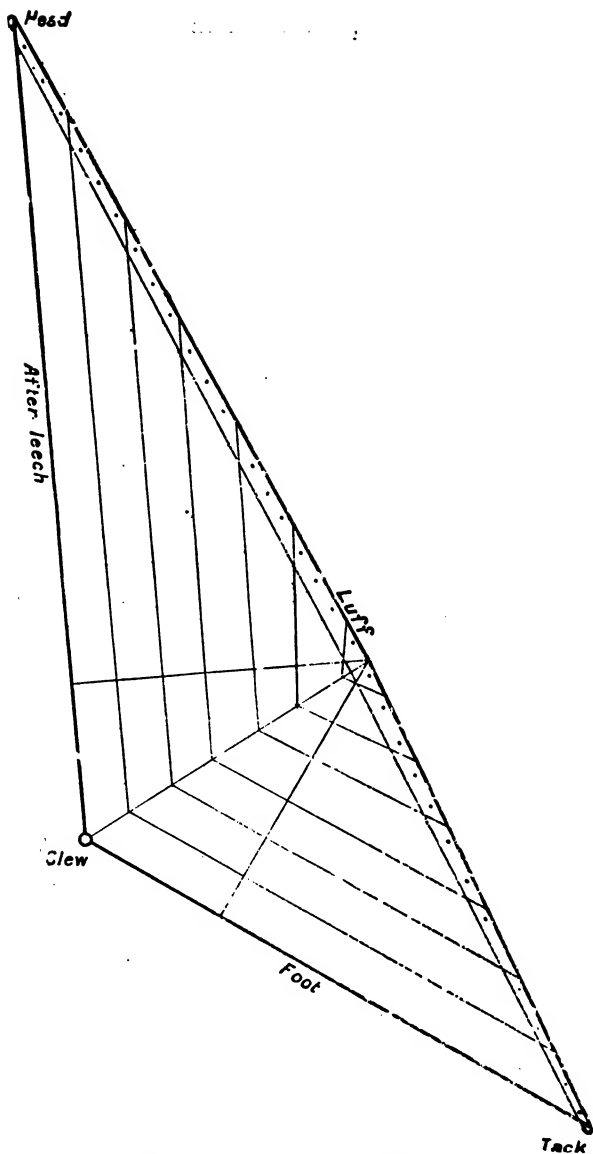


FIG. 16.—FORE-AND-AFT SAIL.*

* A fore-and-aft sail made this way sets and keeps much flatter than one made with cloths parallel to leech.

A very good plan for reeving fresh running gear, or indeed any new rope, if it is difficult to get at the leads or blocks, is to "*marry*" the end of the new rope to the end of the old. A seizing is placed on each, the two ends placed together and fixed by means of twine.

Fig. 15 shows the fitting of the gear on a course.

Figs. 15 and 16 also show names of parts of square sail, and of a fore-and-aft sail.

SEIZINGS.

Seizings, wire or hemp, are used for securing the parts of a hemp or wire rope side by side, as in stopping a block, making an eye

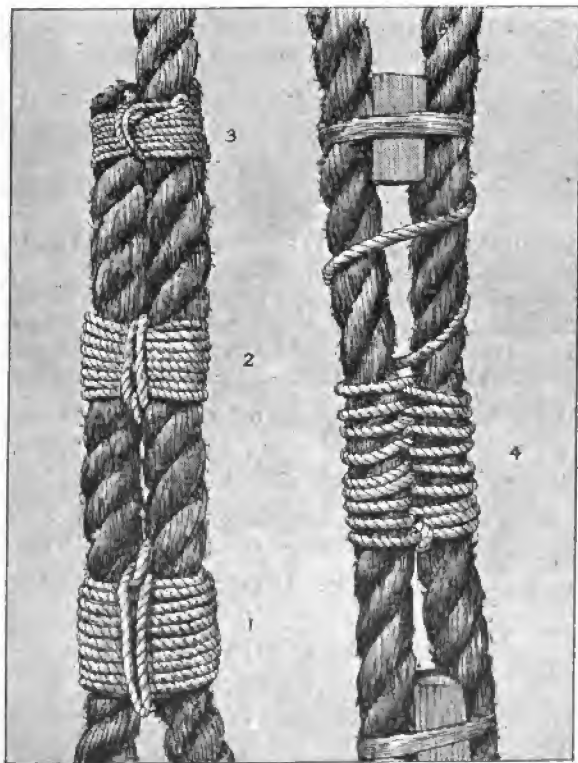


FIG. 17.—SEIZINGS OF ROPE.

in the bight of a rope, or an eye in the rigging for putting over the masthead.

The principal seizings in use are: the throat (1), quarter or round (2), end (3), and racking seizings (4). The throat and quarter are elaborated end seizings. Racking seizings are used for racking two ropes together to keep them from slipping. The quarter or round seizing (Fig. 17) is made as follows: Take a piece of amber line and splice an eye in it; place it round the parts to be seized, and reeve the end up through; then take from six to ten turns round the parts of the rope, heaving all well tight; then bring up the end through the end bight, take two riding turns, heave all taut, and pass the end through riding turns to form a reef knot. In the throat seizing, riding turns would be taken. In seizing over a served rope, a strip of canvas should be laid in the service to prevent the turns of the seizing stuff working in between the parts of the service.

Two or three rope yarns, laid up together and rubbed down with a piece of tarry canvas, form a fox, useful for making a seizing.

LEAD AND LOG-SHIP.

Lead-lines are generally made from a special kind of cord which is water laid. Marks are made on the deck, one fathom apart, either by nails or paint. The line (after being well stretched and soaked, and having an eye, eight inches long, spliced in its end) is marked off in length. The bight of the eye is laid against one of the marks, and the line measured off from it, and marked as follows.*

1 fathom, deep.	10 fathoms, piece of leather with
2 fathoms, piece of leather with	hole in it.
two ends.	11 " deep.
3 " piece of leather with	12 " deep.
three ends.	13 " piece of blue cloth.
4 " deep.	14 " deep.
5 " piece of white calico.	15 " piece of white calico.
6 " deep.	16 " deep.
7 " piece of red bunting.	17 " piece of red bunting.
8 " deep.	18 " deep.
9 " deep.	19 " deep.
20 fathoms, piece of cord with two knots.	

* This extraordinary method of marking the lead-line was apparently first used by the old Dutch seamen in crossing the narrow strips of shoal which abound off the coasts of Holland. Soundings only were marked on the shoals: safe depths were unmarked, and were called "dieps."

No marks are put at the "deeps."

The line is marked with different kinds of stuff, so that the marks may be distinguished by touch at night time, when it would be impossible to see a colour. The length of a hand lead-line is from 25 to 30 fathoms. The lead used with it weighs from 7 lbs. to 14 lbs. A hollow is scooped out of the lower end, into which a mixture of tallow and flour, called arming, is put when in use. The mixture secures and brings up a specimen of the sea bottom, unless it happens to alight on hard rock. A becket is fitted to the top of the lead, by which to attach it to the line. A deep sea lead weighs 28 lbs., and is similarly fitted to the hand lead. The length of line is 100 fathoms. Up to 20 fathoms it is marked in the same manner as the hand lead; from 20 fathoms the knots are added in the proportion of 3 knots for 30 fathoms, 4 knots for 40 fathoms, and so on, up to 10 knots at 100 fathoms. At each of the intermediate 5 fathoms, 1 knot only is placed.

It is usual to fix some place at the side of the ship, where the leadsman (as the person heaving the lead is called) can take up his stand, and have a clear space for heaving the lead properly. In taking up this position, see that the line is coiled up clear for running, hold it in one hand, and grasp it with the other, about two fathoms from the lead. Swing the lead backwards and forwards two or three times, then, when on the forward swing, let go; it will fly well out ahead, and the line will uncoil from the other hand at the same time.

The coil should be held in the left hand, and the lead hove by the right hand, when standing on the starboard side of the ship; and *vice versa* when on the port side. Sing out the soundings so as to be heard by the officer on watch. The leadsman can tell instantly, by the feel of the line, when the lead touches the bottom. The soundings are announced in a sort of singing way, thus: Suppose he finds a depth of 7 fathoms he calls out, "by the mark 7." If 8 fathoms, "by the deep 8." If $9\frac{1}{2}$ fathoms he calls, "a quarter less 10," and so on.

Soundings should be taken on the weather side of a sailing ship so that the vessel may not drift over the lead.

There are many patent sounding machines in the market. A very simple one, the extreme usefulness of which has been proved by practical tests, is illustrated here (Fig. 18). The line is of steel wire, the lead is an ordinary one. The apparatus can be modified in size and other particulars to suit different circumstances, but these modifications do not alter the nature of the instrument (see the table, p. 158, which is a great assistance in sounding rapidly).

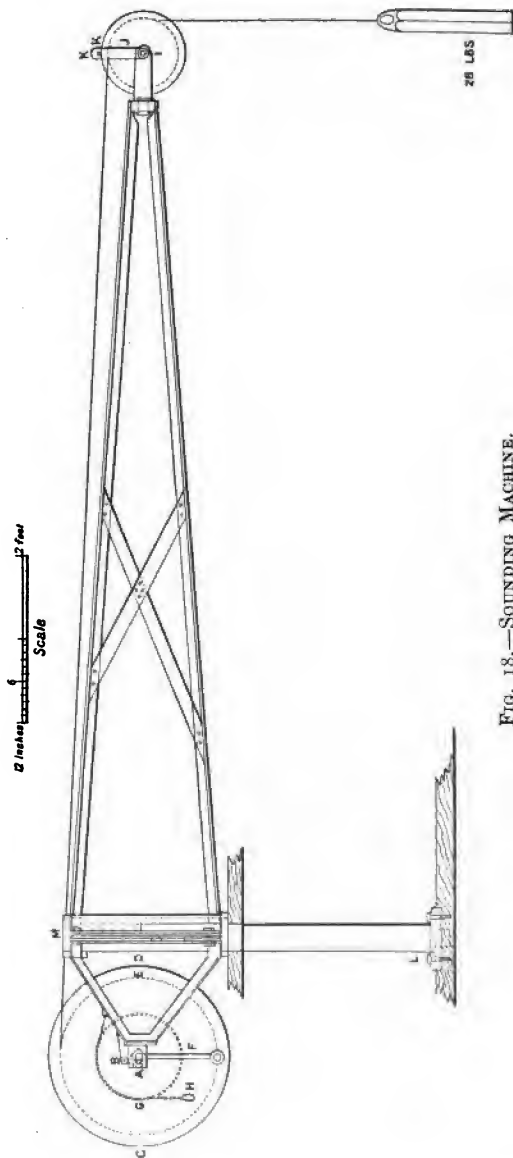


FIG. 18.—SOUNDING MACHINE.

This apparatus can be fixed where chiefly required. This is probably on the bridge. It can also be made available for fitting the Log-line to when the log is towed alongside the ship.

A. Slot for slipping in spindle of drum. B. Pin to hold in spindle of drum. CD. Drum for wire. DE. Depth of flange. E. Part of drum on which wire is wound, and which is exactly one fathom in circumference. F. Handle with which to wind in

wire. G. Break flange. H. Weight controlling break. I. Swivel wheel to lead wire over ship's side. J. Wire guard with pin K, to prevent wire jumping the lead.

The whole apparatus turns round on the stanchion L, M, and can be unshipped. On the side opposite to the handle is fixed an indicator to register revolutions of the drum. By substituting a log-ship for the lead, the wire can be used as a Log-line.

The gear of this sounding machine is handy for use with the ordinary Log-ship * (Fig. 19). A log-ship (2) replaces the lead, and the apparatus becomes an ordinary log-line on the following plan: A line is attached to each corner of a piece of wood shaped like 2, Fig. 19. A plug, which can be withdrawn, is fitted into one of the corners. The bottom is leaded, so that the wood floats upwards, a sand-glass (3) is used which runs to 28 seconds. The problem

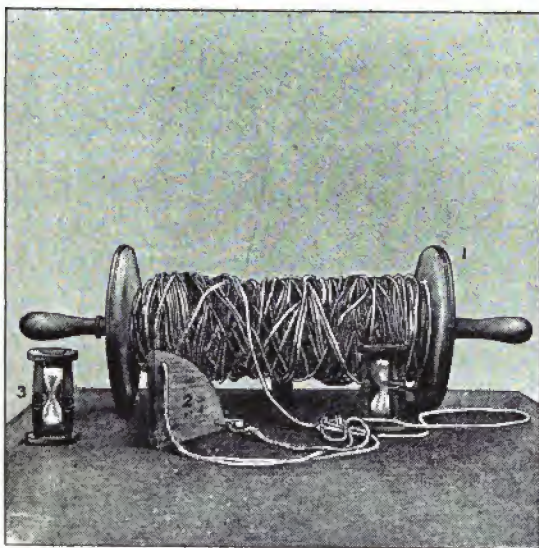


FIG. 19.—LOG-LINE, ETC.

is, to mark the line in the same proportion of a knot as the sand-glass is of the hour. The question is as follows:

$$\begin{array}{ccccccc} \text{seconds} & & \text{seconds} & & \text{feet} & & \\ 3600 & : & 28 & :: & 6087 & : & x \end{array}$$

x being the length on the log-line required to represent a knot. A certain portion of the line (1), called the *stray line*, is first marked with a piece of bunting. Its purpose is to allow the log-ship to get clear of the ship's wake.

* In which case the distance is read off on the counter in fathoms.

The line is then marked to the length x , which is equal to 47'. One knot at $\frac{1}{2}x$, a piece of leather at x , 1 knot at $1\frac{1}{2}x$, 2 knots at $2x$, and so on.

If the ship is going at a rate exceeding 5 knots per hour, a 14-second glass may be used. In this case, the number of knots run out may be doubled.

Log-lines should be wet before they are marked.

Patent logs, which are those in general use, have dials, which indicate the distance run, fixed on to the rail of the ship. The

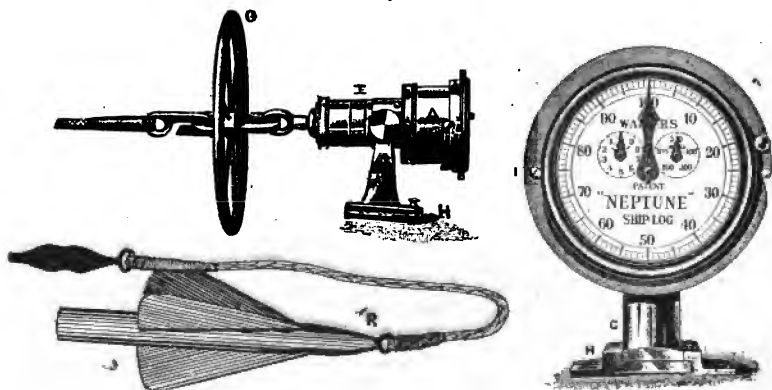


FIG. 20.—PATENT LOG.

hand log is often of great service, and when it is run from the sounding machine, there is no difficulty in taking rapid observations with it.

Fig. 20 represents the parts of a patent log which, when in use, is fixed to the taffrail of the vessel by the shoe H. The case A covers the wheelwork, and the case E contains the spindle and specially constructed steel ball-bearings. Both these cases (A and E) have large openings formed in them (closed by sliding tubes) to enable the whole of the working parts to be easily accessible for examination and oiling while the log is at work. The rotator R is attached to the governor G by means of a special kind of line measuring from 40 to 65 fathoms in length, the length depending largely upon the speed of the ship. There are various appliances by means of which the dial of the patent log can be read on the bridge.

The speed of the ship can also be judged from the revolutions of the propeller.

SPANISH WINDLASS.

A Spanish windlass is very useful for drawing the parts of a block strop together, in order to get the seizing on properly ; also

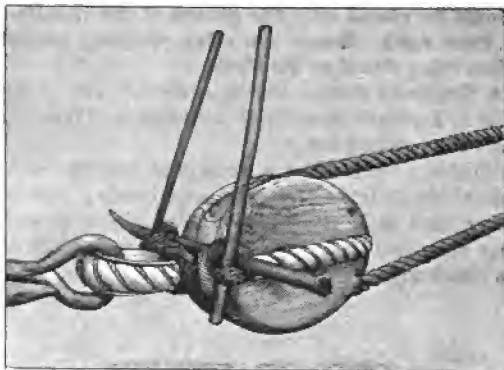


FIG. 21 —SPANISH WINDLASS.

for setting up t'gallant rigging, and for many occasions when it would be difficult to rig a tackle.

A strand is taken and the end knotted to form a strop. The strop is taken round the parts to be drawn together ; and the bight ends are brought up to a bar on either side. A bar or spike is placed in these bighted ends which are hove round the bar, and thus the parts are drawn together (Fig. 21). There are diverse methods of applying a Spanish windlass. The above are general principles which can be modified to suit different cases.

BLOCKS.

Blocks are stropped, or strapped, by fitting a rope round them, and either splicing the ends or making a grommet. The former is the method more generally used ; the latter makes the neater job.

To stop a block, take a piece of rope the required size, cut it so that its length is once and a half the round of the block in the stopping groove or score. Short splice the ends, and take care to put the block into the rope the right way.* Place the thimble, draw the parts of the strop together between the thimble and the block with a Spanish windlass, and put on the seizing. The whole should be kept on the stretch by means of a line rove through the block, the thimble end being seized to something. A piece of old canvas should be placed over the groove of the thimble (to save the rope from rust). Strops are often wormed, parcelled, and served before being placed on the block.

To fit a Grommet Strop.—Unlay a strand from a rope, make a strop of it by laying it up on itself and tucking in the ends. Then proceed as with a spliced strop.

Stropped blocks have fallen a good deal into disuse, as blocks are nowadays fitted internally with iron bands; and many are entirely composed of iron. The block to take a rope should be three times the size of the rope. Thus a 9-inch block should be used for a 3-inch rope.

TACKLES AND PURCHASES.

These are combinations or systems of blocks and line, by which the power of lifting a heavy weight is greatly increased, the increase being in proportion to the number of sheaves in use. The moving part of the rope is called the fall. The part made fast is the **standing part**, and the hauling part is the **running part** or end. A single block forms a lead for a rope. The addition of a second block forms a purchase. Every additional sheave next the weight through which the line is passed decreases the power required about one-half. For example, in a luff tackle, a weight can be lifted by a weight about a quarter as heavy as itself. In a threefold purchase, one-sixth the weight will do it, and so on. To ascertain the purchase required to lift a weight, knowing the power available, divide the weight to be lifted by the power; the result will be the number of parts of rope to go to the lower block. For instance, suppose 20 tons are to be raised, and that there is an available power of 3 tons, divide 20 by 3; the result is $6\frac{2}{3}$; hence 7 parts of the rope must go to the block near the weight. It will be necessary to have a threefold purchase, with the standing part made fast to the

* Into the largest part of the sheave hole next to the seizing.

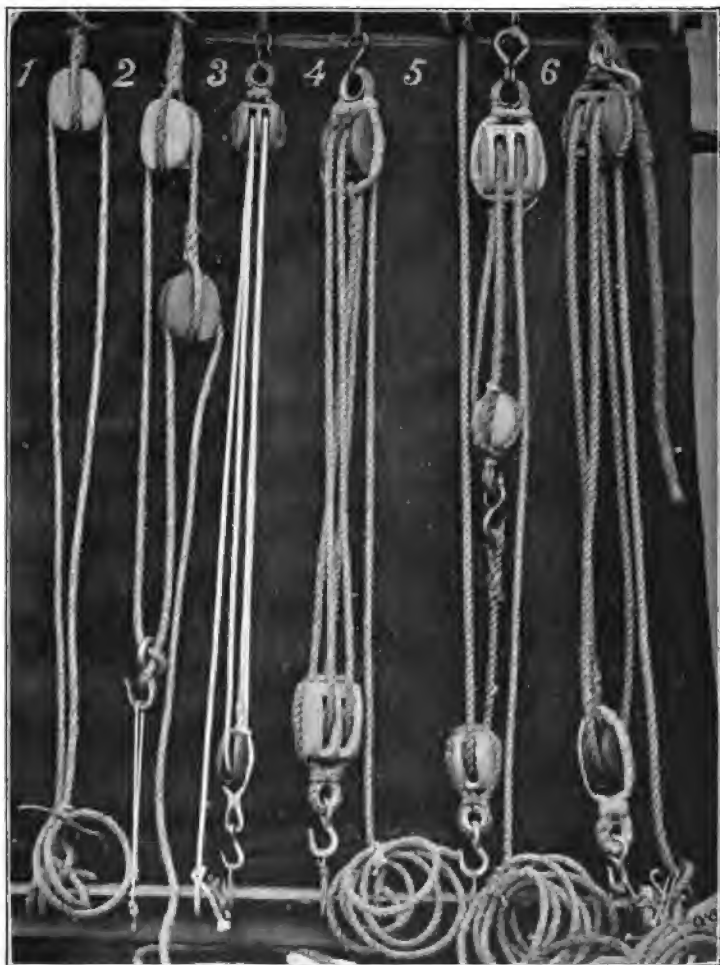


PLATE XII.—TACKLES.

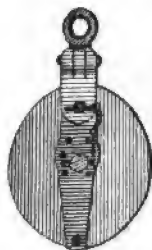
1. Single whip.
2. Spanish burton.*
3. Tackle.

4. Luff tackle.
5. Runner and tackle.
6. Handy Billy.

* Much used for working out cargoes from a span between the masts.

lower block (the one nearest the weight.) As each part of the rope will have to bear a weight of about $3\frac{1}{2}$ tons, its size can be judged accordingly.

FIG. 22.



BULLIVANTS' SNATCH BLOCK.

* This part works on a hinge to allow the bight of a rope to be placed or "snatched" on to the sheave.



SINGLE TACKLE.

PART IV

A.—RIGGING, ANCHORS, ETC.

Rigging—Rattling down—Anchors and } Cables—Anchoring—Laying out
an Anchor—Sending Yards up and down.

RIGGING.

It is seldom necessary to fit rigging at sea ; but it is desirable that an officer should know how to do it, in cases of emergency, when, in consequence of accident, a ship arrives in a foreign port completely dismasted, and has to be entirely refitted there. It is not difficult to cut out shrouds, when the drift from the masthead to the dead-eyes or screws is known. Care must be taken in working aft to allow for the extra drift required, in consequence of the eyes of the shrouds lying one over the other. It only takes a simple calculation to determine the drift, when the height of the masthead from the deck is known. The shrouds can be prepared as quickly as the masts can be made ready for them.

When the shrouds are cut to the required length, fit them in pairs. The bight forms the eye which goes over the masthead. Proceed to splice the ends round the dead-eyes, or into the heart of the screws. Each pair of shrouds, as they are finished, should be carefully marked with a canvas tally. The shrouds are sometimes served all over, but this is absolutely necessary only in the eye, and over the splices. Good three yarn, spun yarn, or amber line should be used. A coating of tar will prevent rust. Plenty of room must be allowed in the eyes that go over the masthead. The parts should be well seized together with a throat seizing (Fig. 19), which ought to come well below the bolsters. If a shroud is found to be too long, or too short, when the rigging is finished, corrections may be made by putting in, or taking out, a turn.

The knot in a rope lanyard, and the splice which fixes the wire lanyard to the upper dead-eye, should come under the spliced end of the shroud, where dead-eyes are used.

Stays are double in lower masts. They are generally set up

with hearts and lanyards, and fit round the masthead with a long collar, as a rule, over the shrouds. The after-part of the bight comes half-way up the masthead to its position, where it rests on a strong cleat. For convenience in placing, stays are often fitted with lashing eyes abaft the mast, and after these are secured the stay is set up with the lanyards forward. The serving is the same as in shrouds. A large mat should be put in the lower stays, in the wake of the belly of the course, to save the sail from being chafed. The stays of lower masts and topmasts set up to the deck, t'gallant stays to lower mastheads, and royal stays to topmast cross-trees.

There is usually an extra topmast stay to carry a stays'l. Battens are also fitted on the foremast shrouds, and on the lanyards, to avoid chafing from the foot of the course when sheet is aft.

In *steamers* the rigging is fitted with eyes and is shackled to the masthead.

SETTING UP RIGGING.

To set up lower rigging with lanyards, first secure the stay and get the mast right for rake, then start on the starboard foremast pair of shrouds and work aft in the order in which they have been put over the masthead. The mast coat * will be a guide as to the uprightness of the mast. A runner and a tackle are generally used for setting up. They are fitted in the following manner (see Fig. 23):

Prepare a luff tackle, a selvagee strop, a piece of round wood (about a foot long) for a toggle, a runner, and a strop for the masthead. Secure the strop under the top; hook to it one of the hauling blocks of the tackle, and overhaul the other block down. Make fast the standing part of the runner some little distance up the rigging, and attach the lower hook of the luff tackle to the other end of the runner. Take the round piece of wood known as a "toggle," and make a couple of turns with the lanyard round the toggle. Wrap a piece of canvas about the two parts of the lanyard underneath, place the selvagee strop round this, and then hook the runner block on to it. Next proceed to set up, and take the end of the luff tackle to the winch or capstan; if these are wanting another tackle must be put on to get the necessary purchase.

The lanyard should be well greased before setting up. One hand should be ready with a spike to work the lanyard about to help it to render well.

* The *mast coat* is canvas fitted round the hole in the deck through which the mast goes, in order to prevent water going below.

T'gallant rigging can be set up with a Spanish windlass ; and topmast rigging with a tackle, or a Spanish windlass.

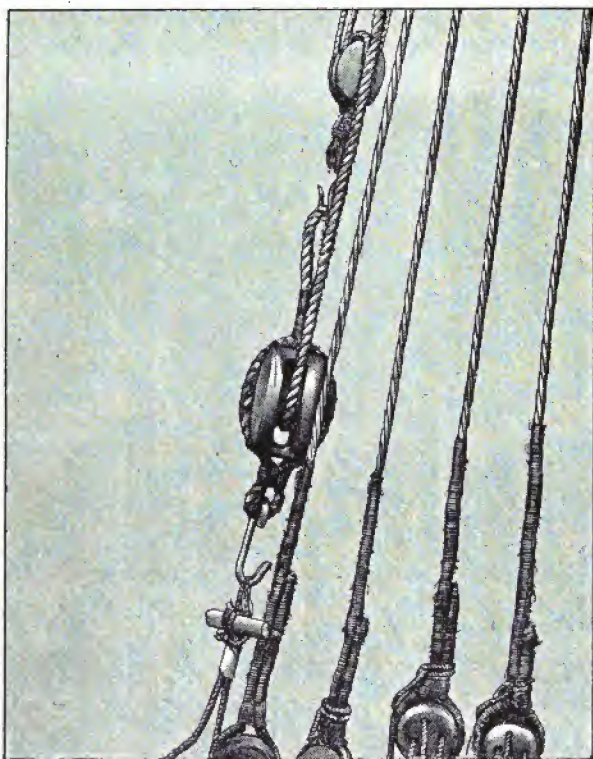
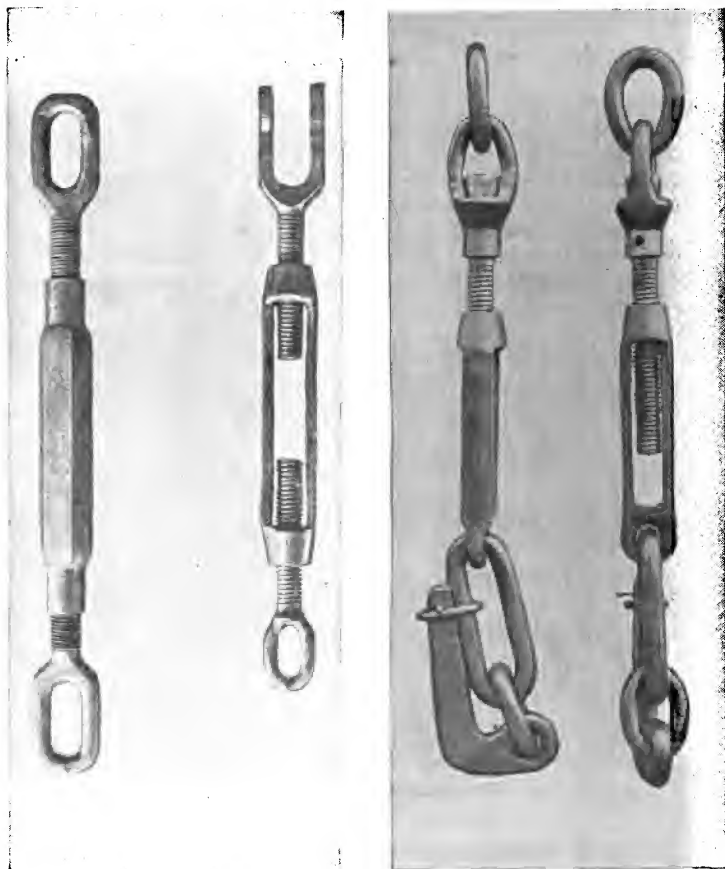


FIG. 23.—SETTING UP RIGGING.

All that is necessary in setting up with screws is to take off the canvas covering, put the bar in tube, and screw up.

Fig. 24 (a) shows a straining screw for tightening up, and (b) a screw for setting up rigging, fitted with slip hook, as made by Messrs. Bullivant.

[BULLIVANTS' RIGGING SCREWS.



a
a. Straining Screw.

FIG. 24.

‡ A Screw for setting up Rigging fitted with Slip Hook.

RATTLING DOWN.

As an example the Port main rigging will be taken. First stretch well the coil of ratline stuff and take out the turns. See that the sheer-pole (Fig. 25 [4]), from which all the measurements are taken, is properly fixed in the rigging, exactly in a line with the sheer of



FIG. 25.—RATTLING DOWN RIGGING.

the vessel. Then, by means of a line (1), slightly swift in the rigging at intervals. Next lash some spars (2) (oars are capital things for the purpose) across the rigging, five feet apart, measuring from the sheer-pole. Be careful to have the forward ends of the spars close to the swifter; or a hole will soon be made in the mains'l. The apparatus required will be a marline-spike, some small seizing stuff, a grease-pot, a tar-pot, and a measure for taking the distance between the ratlines.

The measure must be 15 inches, as that is the usual amount of

space between the ratlines. All these implements should have lanyards attached to them. Take one end of the ratline stuff (which should be coiled on deck by the after part of the rigging) up the after part of the rigging. Stand on the sheer-pole, and loosely clove-hitch the ratline stuff from the after shroud but one to the foremast shroud ; then make a small eye splice in the end of the stuff, and seize with a plain or cross seizing to the shroud, 15 inches from the sheer-pole (Fig. 25 [4]).

Heave the turns well tight, and work aft with the clove-hitches all in the same direction. At the last shroud cut the end, but leave a length sufficient to make an eye splice to seize on to the shroud. Do not cut the ends off the last eye splice, as the ratline soon stretches and it is then necessary to take up the slack and put in a fresh eye.

Hitch the end of the stuff above you for the next ratline. Be careful to measure the height at every hitch and seizing. Nothing looks worse than badly rattled down rigging. Remember always to clove-hitch roughly from right to left, then work back from left to right. This method saves ratline stuff and tightens up the hitches in the best way. A man should put $5\frac{1}{2}$ ratlines on a 6-shroud rigging in one hour.

The first five ratlines up are generally iron bars fitted to the rigging. On some ships the space between one pair of shrouds is rattled down with wooden bars all the way.

Every fifth ratline is called a *catch ratline*—and is continued to the after-shrouds. In some cases, every fifth ratline only is taken to the foremast shroud.

It is usual to tar (with Stockholm tar) down rigging every now and then to preserve it.

ANCHORS AND CABLES.

An anchor and a cable are used to secure a ship in a harbour or roadstead. There are different kinds of anchors, ranging from the ordinary old-fashioned form to the modern stockless anchor, which is rapidly coming into favour, owing to the ease with which it is stowed. See Fig. 26 for the names of the different parts of the anchor.

The Chain-cable is shackled on to the ring of the anchor. It is composed of 8 lengths of chain ; each length measures 15 fathoms, making 120 fathoms in all. The chain is brought in through the hawse-pipe, carried over the special barrel of the windlass or capstan, and then down through a chain-pipe (spurlingate) in the deck to the chain locker below formed by closed-in spaces amidships. The chains are stowed here when not in use. The end is made fast to

one of the frames or floor-plates, to secure the end from running out. All anchors and chains are subject to inspection ; they are supplied according to the size of the ship.

In addition to the two bower anchors, there are always on board



FIG. 26.—ANCHORS.

A. Ordinary anchor.

B. Patent anchor.

C. Patent stockless anchor.

D. Patent anchor.

E. Kedge anchor.

PARTS OF ANCHOR.

1. Trend.

2. Shank.

3. Crown.

4. Arm.

5. Fluke or palm.

6. Pea or bill.

7. Stock.

8. Shackle.

9. Balancing link.

ship at least one spare bower anchor, one or two stream anchors (a smaller kind, useful for heaving a vessel off should she get aground), and several kedge anchors. A ship always carries a certain amount of stream chain, for moving her and for use with the smaller anchors in case of grounding.

In shackling the chain cables to the anchor, and one length to

another, care must be taken to have the pin of the shackle aft, otherwise the shoulder of the pin-flange may catch and break the shackle when the anchor is let go, and the chain running out rapidly.

The pins of the shackle are fitted with small holes in one end, to correspond with holes in the shackle flange. This arrangement allows the driving of a wooden plug through shackle flange and pin in a way which prevents its coming out, and yet allows of its being easily broken, when it is necessary to slip the cable.

The shackle securing the chain to the anchor should be fitted with a split ring, a forelock, and a wire seizing.

There are various methods of securing an anchor. The stockless anchors simply heave right up in the hawse-pipe (the crown flange pieces form a convenient stopper to the pipe).

In anchors with stocks, a shackle attached to the shank balances the anchor. A crane or davit is fitted on the forecastle head. The tackle from the davit and crane is hooked on to the shackle, and the anchor hove right up on the bill-board, which is the piece in the bows to which the anchor is secured, with the cat stopper rove through the ring, and shank painter round the shank and one arm. From this place also the anchor is let go.

There is a special apparatus used for letting go the anchor from the bill-board. When there is a high drift from the sea, and the anchor is heavy, it is advisable to let it go from the hawse-pipe, first lowering it to that point with the tackle, and heaving in the slack chain. Stockless anchors are always ready to let go.

In getting the anchor on board, care must be taken to prevent its knocking about, and making a hole through the bows.

The officer in charge of the anchoring should keep the captain informed of the position of chain and anchor when let go, and in heaving up.

It is well to call out the fathoms and general trend of the chain, so that the master may place the ship in the best way to assist in getting the anchor away, or in getting the required chain out.

When heaving in, notice should be given directly the chain is up and down (that is, when it is over the anchor); when it is away; and when it is sighted.

A turn of the engines in a steamer will often simplify the breaking out of an anchor from the ground.

Should the anchor come up foul, (that is, with the bight of the chain caught under or round the fluke or stock), or should there be any other complication, it must be cleared before being got on board.

The shackles should be examined as they come in, in case they may be damaged.

Turns of seizing wire are placed round the studs in the chain to mark off the length. One turn of seizing wire on the stud, one link abaft, marks 15 fathoms; two turns of seizing wire, two links abaft, marks 30 fathoms; and so on, so that it is easy to see the amount of chain out.

From time to time all chains in a ship should be thoroughly overhauled, blacked, resecured, and all pins knocked out and replaced. A good opportunity for such work is when a ship is in dry dock. Anchors should always be buoyed. Buoys may be made for the purpose out of paint or oil drums, or pieces of wood to which a line rather longer * than the depth of water anchored in is bent. The end of the line is clove-hitched over the crown of the anchor. A length of chain on the part attached to the anchor is a useful precaution, as in the event of the cable breaking, or the anchor getting jammed, it could be lifted with this chain.

DIMENSIONS OF CHAIN CABLES, WITH TEST STRAIN AND WEIGHT COMPLETE IN EQUAL LENGTHS.

Diameter of Iron.	Weight of 100 fath., in 8 Lengths, having 4 Swivels and 8 Joining Shackles.	Test Strain, each Length.	Test Strain of 3 Links, each 15 fath.
Inches.	Cwts. Qrs. Lbs.	Tons.	Tons.
2 $\frac{3}{4}$	363 0 0	136 $\frac{1}{2}$	190.5
2 $\frac{1}{2}$	300 0 0	112 $\frac{1}{2}$	157.5
2 $\frac{3}{8}$	270 3 0	101 $\frac{1}{2}$	142
2 $\frac{1}{4}$	243 0 0	91 $\frac{1}{2}$	127.5
2 $\frac{1}{8}$	216 3 0	81 $\frac{1}{2}$	113.75
2	192 0 0	72	100.8
1 $\frac{7}{8}$	168 3 0	63 $\frac{1}{2}$	88.5
1 $\frac{3}{4}$	147 0 0	55 $\frac{1}{2}$	77
1 $\frac{5}{8}$	126 3 0	47 $\frac{1}{2}$	66.5
1 $\frac{1}{2}$	108 0 0	40 $\frac{1}{2}$	60.75
1 $\frac{3}{8}$	90 3 0	34	51
1 $\frac{1}{4}$	75 0 0	28 $\frac{1}{2}$	42
1 $\frac{1}{8}$	60 3 0	22 $\frac{1}{2}$	34.12
1	48 0 0	18	27
$\frac{7}{8}$	36 3 0	13 $\frac{3}{4}$	20.6
$\frac{3}{4}$	27 0 0	10 $\frac{1}{2}$	15
$\frac{5}{8}$	18 3 0	7	10.5
$\frac{1}{2}$	12 0 0	4 $\frac{1}{2}$	6.75

* About two fathoms longer than the depth of water at spring high tides. In some harbours anchor-buoys are not allowed.

ANCHORING A STEAMER.

Before coming up to an anchorage, the officer in charge of the work should see that the chain and anchor are quite clear. The captain judges when it is best to let go, and he gives the necessary order.

A vessel should have either headway or sternway before letting go the anchor, for if stationary the chain would pile itself on the anchor, fouling it; and the vessel could not be brought up in a tideway or strong breeze unless a second anchor were let go.

The state of the weather, depth of water, strength of tide, and nature of the bottom determine the length of chain to be paid out. In ordinary weather the length of cable paid out should be from 5 to 6 times the depth of water.

ANCHORING A SAILING SHIP.

In coming to an anchor with the wind off shore, stow light sails; haul the courses up when near the anchorage, leaving tops'ls, jib, and spanker set.

When arrived at the proposed anchorage, give the orders: "Down helm and down jib"; the spanker boom should be hauled to windward, at the same time, to bring her up in the wind. When the vessel comes head to wind, lay all the yards square; when she gathers sternway let go the anchor, lower away the upper tops'ls, and as she takes the chain, clew up the lower tops'ls, veering chain as required.

If coming to an anchorage with the wind aft, choose which way to turn the ship, paying due regard to the vicinity of other vessels.

The second anchor must in all cases be ready to let go, and attention should always be directed to the prevailing gales.

GETTING UNDER WEIGH IN A SAILING VESSEL.

If the wind should be off the land, shorten in cable, loose the tops'ls and courses, set the upper tops'ls, brace after yards upon the tack you wish to cast on and the head yards a-box. Have head sails and spanker ready for setting. Helm hard a-lee. Trip the anchor and, when the wind is somewhat on the weather bow, hoist the head sails sheets to windward, so as to get her head off. Directly the after-yards fill, brace round the head-yards, lee head-sheets aft and set the spanker, using the helm as may be required. Heave the anchor right up, cat and proceed to set the lower tops'ls, courses, &c. Judgment must be exercised in setting sail, and

attention paid to the proximity of other vessels. It is important that the anchor should be secured while the vessel is moving easily. Should the ship be on a lee shore, it may be necessary to slip the anchor instead of heaving it up.

SIZES, LENGTH, WEIGHT OF CHAINS AND ANCHORS AS PER LLOYD'S REGULATION.

Ship's Tonnage.	Size.	Length in Fathoms.	Bower Cwts.	Stream Cwts.	Kedge Cwts.	and Kedge and Kedge Cwts.	No. required.		
							Bower.	Stream.	Kedge.
100	13-16ths.	150	5½	1½	1	...	2	1	1
150	15-16ths.	180	8½	2½	1½	...	2	1	1
200	1 1-16th.	180	11	3	1½	...	3	1	1
250	1½	210	14	4½	2½	1	3	1	2
300	1 3-16ths.	210	16½	5	2½	1½	3	1	2
350	1½	240	19	6	3	1½	3	1	2
400	1 5-16ths.	240	21	6½	3½	1½	3	1	2
450	1¾	270	23	7	3½	1½	3	1	2
500	1 7-16ths.	270	25	8	4	2	3	1	2
600	1½	270	29	9	4½	2½	3	1	2
700	1 9-16ths.	300	32	10	5	2½	3	1	2
800	1¾	300	35	10½	5½	2½	3	1	2
900	1 11-16ths.	300	37	11	5½	2½	3	1	2
1000	1½	300	40	12	6	3	3	1	2
1200	1 13-16ths.	300	43	13	6½	3½	3	1	2
1400	1¾	300	45	13½	6½	3½	3	1	2

MOORING.

Just before reaching the spot, let go one anchor, and keep enough way on the ship to stand over the place, paying out chain all the time; then (having overshot the mark sufficiently, and brought the ship up) let go the other anchor, and give her sternway. Pay out, at the same time, the chain last let go, and heave in on the other until the right position is obtained. It is very necessary to know the direction of the tide. A ship when moored occupies much less room swinging than when lying to a single anchor.

In unmooring, pick up the lee anchor first; slack away on the other chain, so as to get over the anchor, and when it is up, proceed to pick up the other. Judgment must be used as to which anchor it will be best to pick up first.

Should the ship swing, a foul hawse is likely to occur. To clear
E

this the two cables must be lashed together outside, the lee chain unshackled inboard, its end passed out and round the other so as to clear the turns, then inboard again and shackled on. Or the foul may be cleared by shackling a wire hawser on to the lee cable, unshackling the chain, dipping it round and shackling it on again.

If a ship is to be moored in a harbour or river for long, a mooring shackle (which is a large swivel with four links attached) should be used.

The cables are unshackled and then shackled to the four links. The movement of the swivel prevents turns in the cables.

While the chain is being unshackled for the purpose of placing the swivel, its anchor side should be held by a chain or wire stopper. The swivel should be put on cup uppermost, so that it may be easily lubricated, and a mark should be put on the cables to distinguish them from one another when the swivel has to be taken off.

LAYING OUT AN ANCHOR.

It is often necessary to lay out an anchor, either to warp the ship round, to act as a spring, or to heave her off a bank. For this purpose a kedge, or stream anchor, is taken out in a boat, with sufficient stream chain, or hawser, and let go.

The end of the chain, or warp, is then taken on board and hove in on. A square-sterned cutter is the best boat in which to take out the anchor from the ship. There are three methods of carrying out a small anchor.

First method: Take three capstan bars and fix them over the stern, as in Fig. 27, which shows:

1. Capstan bar laid athwart boat's gunwale.
2. Capstan bars laid end over the stern, and on top of capstan bar 1.
3. The anchor to be taken out.
4. Stream chain or wire hawser coiled in boat on the thwarts.

The anchor is stopped to the boat, and when required to be let go, the anchor stops are cut, the capstan bar (1) is raised, and the anchor slid over the stern, care being first taken that sufficient chain or hawser is paid overboard (before letting the anchor go) to enable it to reach the bottom, without jerking the hawser or chain out of the boat. Chain can then be paid out gradually, the stops being kept on the bights to keep it from running out too fast.

In the second method,* the boat may be fitted with a movable

* I am indebted to Captain P. Thompson, F.R.A.S., late of the Local Marine Board, for this handy method.

davit in the stern-sheets, and the anchor laid in the stern-sheets, with stock up and down over the stern, and one of the flukes resting on the gunwale, the other in the bottom of the boat ; from this position

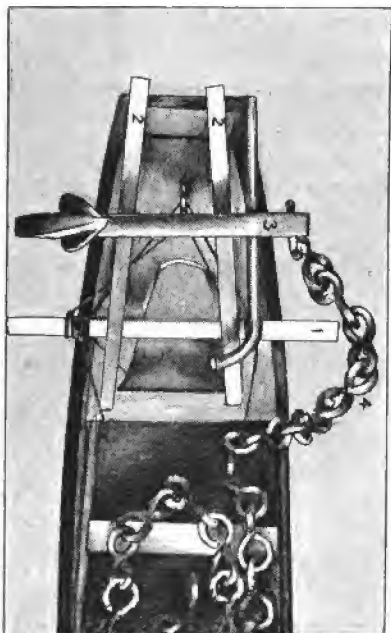


FIG. 27.—LAYING OUT AN ANCHOR.

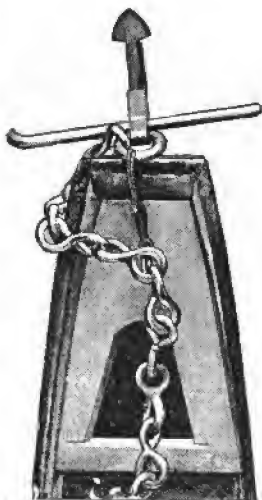


FIG. 28.—LAYING OUT AN ANCHOR (ANOTHER METHOD).

it can easily be tipped over the side by lifting upon the fluke that lies in the bottom of the boat.

In the third method the anchors can be hung over the stern amidships, by a stop to the ring, and let go when required (Fig. 28).

In all cases it is well to take the precaution of paying over a sufficient amount of chain or hawser to reach the bottom. A spar over the gunwale aft will save it from being chafed by the chain.

The boat can be steered by an oar: *buoys* should always be fitted to the anchors, and with lines strong enough to lift them.

GETTING A STEAMER UNDER WEIGH FROM A WHARF OR PIER.

Junior officers are stationed on the Bridge and at both ends of the ship. Their duty is to see that all is clear and particularly that boats, ropes, &c., at the stern do not get in the way of the propellers.

MOORING OR MAKING FAST TO A WHARF OR PIER.

As a rule, vessels loading or unloading in large ports lie alongside a wharf or pier. Vessels require careful and skilled handling in navigating docks and sometimes the help of a tug or of lines or warps is necessary.

A **Heaving Line** is a small line weighted by a number of knots in the end. This line is held coiled in the hand and is slung aboard from the wharf as the vessel comes close to ; it is then attached to a warp, which is paid overboard (through a lead) and made fast ashore so that it can be hove in by means of a winch or capstan. Sometimes the warps are made fast on board and hove in on shore.

When the wharf or pier is too far from the ship, or when "hands" are scarce on shore, as happens in the Suez Canal, the warps are run out from the ship to the shore in a boat. The necessary length of rope is calculated roughly (hence the name of **guess-warp**), coiled down in the boat (clear of oars, &c.) and is paid out on the bight as the boat approaches the shore.

This method of paying out warps is followed also when a line is run out to a buoy, to heave a vessel away from a wharf or to cant her head in the desired direction for steaming out. The rope is not paid over the ship's side, because that would involve great strain on the boat's crew.

Great care is requisite when rendering warps round bollards or winch barrels under heavy strain to avoid carrying them away.

Where there is any rise or fall of tide lines, warps and chains require constant attention to allow for this.

Mechanical and electrical signals, by means of which orders from the Bridge can be given immediately to either end of the ship, are now fitted in most vessels.

TENDING A SHIP IN A TIDEWAY.

Too little attention is now given to tending a ship in a tideway : probably because, except in the case of laying up altogether, vessels do not nowadays delay long in a river. But a ship at anchor may

benefit much by judicious tending. In a strong tide, she will probably yaw about and even come ahead of her anchor, unless given the touch of the helm which will make her steady and comfortable. In a crowded river, a certain amount of tending is essential. When vessels are laid up for any length of time they are usually moored with a swivel on the cables or are placed at a buoy so as to cause no anxiety.

In the case of a sailing ship, the masts and yards offer a certain hold for the wind, which thereby becomes a disturbing element unless they are correctly trimmed.

Experience soon teaches the best course to follow in these details.

SENDING YARDS UP AND DOWN.

T'gallant and royal yards are sent up and down by a single yard rope. This operation had formerly to be constantly performed at sea. It is not often necessary nowadays, except in port, when it may be desirable to get rid of as much top hamper as possible if the vessel is light.

Reeve a rope (the size of which will depend, of course, upon the weight of yard) through the masthead sheave, or through a block lashed there; bring the end down on deck, on the weather side (if at sea) clear of yards and gear, and bend it on to the halliard shackle of the yard. Stop the gantline out on the yard-arm side you wish to go up first, about 18 inches or 2 feet from the shackle for the quarter stop; and at the yard-arm for the yard stop.

This will insure the yard going up straight. See that the lifts, for shackling on to the masthead, and other gear are clear; put a tripping line on to the lower yard-arm, to steady it up, and hoist away. As soon as it is well up on the mast, by the cross-trees, put the braces and lifts on, and take off the yard-arm stop, shack'e in the lifts to the masthead, lower the yard, ease up the quarter stop and secure the parrel as the yard lowers into its place.

Cast off the gantlines, shackle on the halliards, pass and secure the foot ropes, and see that the halliards are quite clear of stops, and that the braces and lifts are in order. The tripping line can generally be dispensed with in harbour. In some cases the lifts are fitted to the masthead with lashings, and in other cases the topgallant lifts are led through a thimble, and down to the cross-trees. Heavy topgallant yards are fitted with a chain tie, a wire runner, and a tackle.

Topsail Yards are sent up with a tackle or stout gantline, which should be secured just outside the tie band of the yard. Another

single gantline (topping rope) should be rove through a block, on the head of the topmast, and made fast to the yard-arm, on the side to which the yard tackle or rope is made fast.

When hoisting commences, the topping rope serves to cant the yard up on end (it really takes the place of a yard-arm stop) ; a tripping line may or may not be necessary, circumstances must decide that.

Put lift and brace on the upper yard-arm, when it reaches the top, and heave away. As soon as it is clear of the topmast-stay, shackle, or secure the lift, and get the lower yard-arm lift and brace put on. Heave away, slacking on the topping-lift so that the yard can square somewhat ; get the lower lift fast, slack down the yard tackle, or rope, and secure the parrel and topsail tie (if an upper yard) ; or fix on to the crane (if a lower yard). Upper topsail yards are fitted on the tie band with an iron block, through which a chain is rove. The standing part of this chain is fixed on to the fore part of the topmast trestle-trees, and the other end rove through the sheave at the topmast-head under the cross-trees. There is a block shackled to this end, through which is a runner with three-fold tackle attached. Sometimes the tie is single, in which case the runner abaft is generally double.

PART IV—(continued)

B.—SAILMAKING.

It is unlikely that a young officer will be called upon to cut out and make new sails ; but it is important that he should thoroughly understand the principles of sailmaking, as much of the repairing and mending required may come under his direction on a sailing ship, and possibly also on a steamer.

It is customary to carry two suits of sails. A third set of lower topsails is also frequently carried.

The best sails are bent where the worst weather and strongest winds are encountered. The second suit is used in the tropics and trade-wind regions

The tools employed in sailmaking are :

1. **Palm**, which is worn on the hand, and used for forcing the needle through the canvas.
2. **Creasing stick**, a piece of hard wood or steel, split at the end, used for creasing seams.
3. **Needles**, which are three-cornered, and which should not have the edges too sharp, or they will cut the canvas threads when pushed through.
4. **Fids** of different sizes, for making eyelet holes and stretching cringles.
5. **Anvil**, for knocking in patent thimbles.
6. **Grease horn**, to hold grease, into which the needle used in sewing is dipped now and then
7. **Rubber**, for rubbing down seams, a piece of steel set in a wooden handle
8. **Pricker**, a kind of fine marline-spike, set in a wooden handle, for piercing holes in the canvas.
9. **Sail hook**, for holding the canvas while stitching.
10. **Blue pencil**, for marking, &c.
11. **Knife**, preferably a shoemaker's knife.

Canvas or sailcloth is made of long flax and is put up in rolls

or *bolts*, as they are called. The canvas in each bolt has an average length of forty yards, and a width of twenty-four inches.

The threads running lengthways are called the *warp*, and those across, the *weft*. The edges are called *selvages*.

In cutting canvas—except for gores or other special purposes—care should be taken to cut with the thread. When canvas is cut at an angle, it is called a *gore*. This gore must be carefully cut if the sailmaker would avoid a baggy sail.

Canvas varies in stoutness, and runs from 1 to 8. No. 1 is the stoutest and No. 8 is the lightest, but No. 6 is the lightest in general use.

Tarpaulin canvas is a coarser and commoner canvas for making hatch-covers and such-like.

If a prickler be thrust through good canvas the threads break with difficulty. In selecting canvas the best quality should be chosen.

Boat sails are generally made of duck, which is usually split up the centre.

Twine made of flax is used in joining canvas to make sails. There are two kinds of flax twine. The ordinary one is made up of three strands running about 400 fathoms to the pound. A heavier make, called *roping twine*, is used for attaching the roping to the sails.

Before use, all twine should be dipped in Stockholm tar softened with oil, and wrung out. One end of the skein may be cut, so that the threads can be drawn out as wanted, or the whole skein may be balled and cut as required.

As has been explained, a gore is a diagonal cut across the canvas. All sails are gored unless they are absolutely square. All square sails, except the fore course,* are gored on the leeches, and on the foot forming the roach of the sails. The fore course is gored only on the foot. Jibs † are gored on the luff and foot. Great care must be taken in cutting the gores to prevent the sail getting any belly. This precaution is particularly important in fore-and-aft sails.

Tabling is the part of the sail turned in, to which the roping is attached; it is a sort of wide selvage which may vary from six inches in courses to three inches in light sails.

Lining cloths are extra pieces of canvas sewn on to a sail in the way of any chafing (for instance, to the sail on the after part where it is likely to flap against the mast), or in the way of huntlines and spilling lines, &c. Lining cloths are also used to assist in distributing

* In some modern sailing ships there are one or two cloths gored on account of the long bow.

† Except cross-cut jibs shown in Fig. 16.

the strains on a sail, at the clews or at other situations, where they may be subject to violent jerks.

There are three seams generally used in joining canvas. The round, the flat, and the round seam not rubbed down. The round seam is the strongest, but it appears to be going out of use, as the flat seam is made more easily, and is less liable to chafe.

To join two pieces of canvas to make a sail, measure and cut



FIG. 29.—ROUND SEAM.

the length required. Mark the width of seam on one piece, and round seam * the other to it. Place the hook in the canvas to the right hand, and work towards it (Fig. 29). In working, thrust the needle perpendicularly through the parts. A beginner should pay attention to the correctness of his attitude and method of sewing not only because of the greater facility to himself, but because work done in the right way is sure to be well done.

When the round seam is made it should be rubbed down with

* Seams should be $1\frac{1}{2}$ inch wide for heavy sails and $1\frac{1}{4}$ inch wide for light sails.

the rubber. Work from the hook and take care to get the seam quite flat.

Now put in the flat seam Fig. 30), stitch this time from the hook, and keep the fore-arm in a line with the seam.

When sails begin to show signs of wear they should be middle-stitched or side-stitched, that is to say, a plain in-and-out stitch

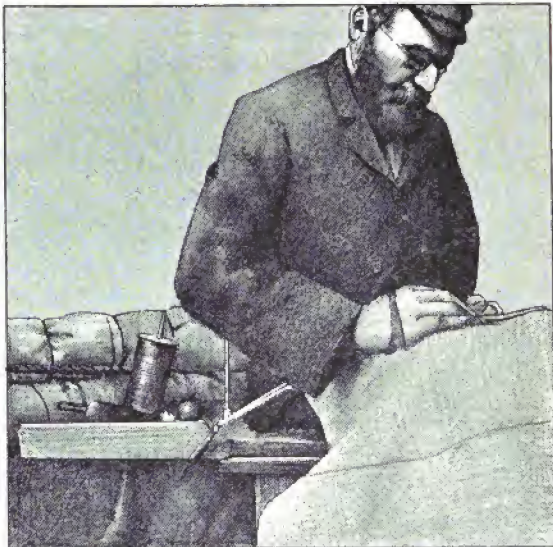


FIG. 30.—FLAT SEAM.

should be run down them parallel to the old seams, and nearer one or other seam than to the centre between them.

Sails should be overhauled before they are placed below, and before bending. Pieces of paper should be liberally strewn about the sail-room if there are rats in a ship, otherwise they will gnaw the sails.

To repair a small rent in a sail, draw the edges together with a herring-bone stitch, and cover the mended rent with a patch of tar.

Roping.—The rope that goes round a sail is known as bolt rope, and is 3-stranded, yarn-tarred, Russian hemp.

Latterly wire has come much into use, and is fast superseding

hemp. Great care has to be taken in attaching hemp rope to the sails, as it stretches a good deal, and can only be properly sewn on to a sail by a thoroughly experienced hand. The rope is sewn to the canvas, not the canvas to the rope, and allowance of slack canvas has to be made. Practice only can determine the amount of slack that should be allowed.

Wire rope should be served all over (not wormed or parcelled), and is spliced direct into clew and earing irons.

Cringles are worked in the head, foot, and leeches of sails, and thimbles are put into them in which to bend the buntlines, &c.; spectacles are spliced into the clews.

Cringles are made of strands of the same rope as is sewn on to the sail; they are worked right round the bolt-rope.

PART IV—(continued)

C.—THE SAILS, ETC.

Bending and Unbending Sails—Making up Sails—Setting Sail—Taking in Sail—Trimming Sail—Tacking, Wearing, and Heaving to—Steering Gear—Sheers—Fitting Topmasts, Topgallant, and Royal Masts.

BENDING AND UNBENDING SAILS.

THE aim in bending sails is to get them into position as quickly as possible.

To attain this end the sail should be made up on deck, the roping down (as it would be when on the yard furled). The earings should be left out. The clew spectacles are left out at the yard-arm or amidships, according as the sail is clewed up at yard-arm or amidships.

The bull's-eyes and the foot of the sail should be easy of access for reeving or bending on the buntlines, leechlines, or spilling lines.

The stops on the sail should be regulated in accordance with the weather. When it is calm no stops are necessary ; but when rough, and the ship is rolling about, the sail must be well stopped up. A tail snatch-block bent on to the sail rope, and the sail rope snatched in it, will steady the sail as it goes up. The earings may be hitched to the sail rope, which should be a single line rove through a block at the masthead, and brought down, so that the sail will go up as clear as possible. In calms, or with the wind well aft, this will be before the yards ; but with the yards braced sharp up it will be abaft, and on the weather side. If the winch is available, the line is led to it, and the sail quickly whipped up.

A hand or two should be stationed aloft to shove it clear as it goes up ; except on a lower topsail—which should be bent with spun yarn—the sail should be made fast to the jackstay with roivings of good Europe rope yarns.

The sail rope should be bent on around the sail, so that the midships head-stop is clear.

In bending a course, the usual plan is to overhaul the buntlines

down, and to reeve them in the sail on deck, stopping the head of the sail to the buntlines and bending on the clew garnets and reef tackles (if used).

It is not necessary to go into details for each sail, as the general



FIG. 31.—BENDING A MAINSAIL AT SEA.

principles laid down can be modified by an officer according to circumstances.

Earrings should be passed as follows: Take the end round the lift bolt on top of the yard-arm, pass it up through the earing cringle (this gives a good purchase to haul out the earing), then pass the end down abaft the yard, and bring it up through the head earing cringle on the fore part of the yard, pass the required

turns, securing the ends when expended or when enough turns have been taken. This will keep it well up on the yard.

BENDING A JIB.

Bending a Jib.—See the hanks all clear on the stay. Stretch the sail out and make it up on the foot, stopping it here and there.

Bend the halliards, and downhaul on to the part just abaft the luff, haul on the downhaul and tend the halliards. A line should be made fast to the clew to steady it out with. As soon as it is out to the stay, secure the hanks (which are on the stay) to the sail, reeve the tack, bend on the downhaul and halliards properly, and shackle on the sheet pendant.

In unbending reverse the process.

A staysail can generally be easily carried to and bent on the stay.

A SPANKER OR DRIVER.

A Spanker or Driver.—If the gaff will not lower down, the brails are overhauled and made fast at the bights to the after part of the sail, which is then hoisted into place. The tack is secured by a line hauled well tight.

A driver is fitted with a tripping line.

SETTING SAIL.

In setting as in taking in sail, the object aimed at is the prevention of the sails beating about more than is absolutely necessary ; otherwise there may be much chafe and wear.

Topsails are generally the first to be set when about to get under weigh. Point the yards to what will be their approximate trim when the sail is set ; loose the sail and sheet home, lee sheet first, then weather sheet. The hands aloft should well overhaul the gear.

In hoisting yards the lee brace should be let go, and the weather brace tended, while the yard is going up (when the wind is well aft *both* braces must be tended or the yard will fly about). Sheets leading to sails above must be let go, also downhauls. Overhaul and stop the gear.

To keep the lifts of the upper yards from chafing the sail when set, place them abaft the yards.

In setting a single topgallant sail or a royal, point the yard to the wind. Loosen the sail lee side first, overhaul the gear and sheet home to windward, then to leeward ; let go the lee brace, hoist the yard and trim.

In setting a jib or staysail, see the downhaul all clear for running, halliards in lead blocks for hoisting. Loosen the sail, let go the downhaul, steady the sheet aft, and hoist away smartly. Have another pull of the sheet, if necessary.

Setting a Driver or a Spanker.—Overhaul the brails, haul aft the sheet to steady the sail, then the outhaul, set the sail properly with a final pull of the sheet, and slack the weather vang.

Setting a Course.—If the yard is braced up at all, see the weather lift hauled well tight (the lee lift will be well overhauled if the yard is sharp up to avoid chafe against the lee rigging). Loosen the sail, overhaul the lee gear, and haul aft the slack of the sheet to steady the sail. Then board the tack, haul aft the sheet to set the sail properly, if on a wind, reeve and haul out the bowline.

TAKING IN A SAIL.

In taking in either a single topgallant sail or a royal, lower the yard, round in on the weather brace, starting the lee sheet at the same time. Haul in smartly on the weather brace, and point the yard to the wind so as to spill the sail. Haul up on the lee buntlines and leechlines (if fitted) and clewlines, then haul up to windward, steady tight the lee brace, halliards, and sheets, lay aloft and furl, commencing on the weather side if single-handed, as this will spill the sail still more, then trim the yard to the wind as if the sail were set.

In taking in a lower topsail, haul up first the weather clew, manning the buntlines or the spilling lines at the same time, to keep the sail steady, then haul up the lee clew.

In hauling up a course, haul tight the lifts and proceed as in a lower topsail. Slack off a fathom or two of the lee sheet as the gear is hauled up. When the weather gear is as high as possible, man the lee gear, haul, snug up, and furl.

In furling square sails,* the leech should be picked up along the yard and then the sail skinned up by reaching over the yard and picking up to the last fold. All should then be tossed well up on the top of the yard, the last skin forming a kind of cover which prevents rain getting into the folds; the gaskets should be passed from before aft up round the fore part of the sail and yard. This tends still further to haul up the sail on the yard. The bulk of the sail will be in the bunt. It is very convenient to have a single whip fitted under the top in the courses, to hook

* That clew up to the quarter of the yard.

on to a grommet fitted in the sail ; this whip can then be used to assist in getting the bunt well up.

Gaskets are placed at suitable intervals on the yards and secured to the jackstay. In the case of the royals and such light sails, they are made fast near the yard-arm, and when loosing the sail (which is done in the bunt) care must be taken not to let the end go, but secure it loosely round the tye when finished. In making sails fast in harbour the gaskets are wound round the sail at regular intervals for the sake of smart appearance.

Taking in a Jib or Staysail.—Man the downhaul and let go halliards, hauling down smartly on the downhaul, until the sheet holds the sail, then slack off sheet carefully and haul down. A wipe off with the helm, for a point or two, will materially assist in getting one of the head sails down, and it will also save a good deal of unnecessary flapping of the sails.

A judicious touch of the helm can often assist very materially in shortening sail, without appreciably altering the course of the ship.

Taking in a Driver or Spanker.—Man the lee brails and the downhaul, if fitted ; slack away the sheet, and haul on the brails (lee brails best) and downhaul. If the weather brails were hauled on, the sail would be kept full of wind, which would prevent its coming in snugly ; but by the hauling on the lee brails the sail is spilled and so comes in very easily.

A **tripping line** is often fitted to lower staysails to lift the clew over the stays, when the staysails are used in tacking ship. There is not much real advantage to be gained by carrying on staysails (except the fore topmast staysail), with the yards braced sharp up.

TRIMMING SAIL.

The young officer should pay careful attention to the trimming of sails and yards, as that is a matter which may very materially affect the length of a ship's passage. A check in of the yard here, a foot or two of sheet there, is likely to add a knot an hour to the speed. The principle on which sails act may be explained briefly thus :

If pressure be exerted on any surface its result is a tendency to move it in the direction in which the force acts. The pressure may be resolved into forces, one of which acts at right angles to the surface. This force may be further resolved (in the case of a sail surface) into two forces, a fore-and-aft and an athwart-ship force.

For instance, in Fig. 32, D is the wind and XY the sail ; the ultimate force of the wind will be represented by the line BA at

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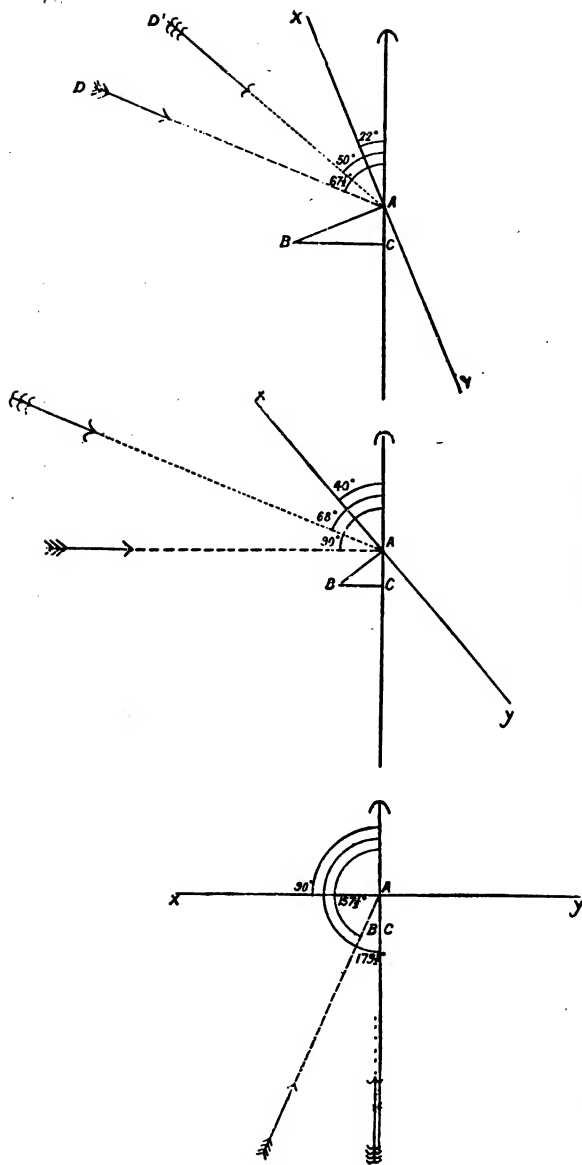


Fig. 32.—TRIMMING SAIL.

True direction of wind.

Apparent direction of wind.

Yard or sail.

Direction in which vessel is moving.

In triangle ACB.

AC = Force tending to send the ship ahead.

CB " " " " sideways.

AB " " " " Useful effect of wind.

D The Wind.

right angles to the surface of the sail XY. (To simplify matters the sail is supposed to be quite flat.)

This force may be resolved by the triangle of forces * into forces CA, tending to propel the ship ahead in the fore-and-aft line, and BC, tending to produce leeway.

In Fig. 32 the letters D, D', show the true and apparent direction of the wind. We say "the true and apparent" because the motion of the ship through the water may draw the wind farther ahead or astern, and so alter its direction and velocity in regard to the course of the ship.

Three different directions of the wind are illustrated. The figures noted in the triangles are drawn to the scale of the speed of the wind, and are intended for comparative purposes only.

As the side of a vessel offers much greater resistance to the water than the bow, the force which tends to send her forward is much more effective than that which inclines her sideways, though the latter may be the stronger of the two.

This is why the ship forges ahead, tending but slightly to leeward. The force sending the ship to leeward is greatest when she is braced sharp up; it diminishes to nothing when the wind is well on the quarter. The illustrations show clearly the alteration effected in the pressures by change in the direction of the wind.

It is difficult to determine exactly the difference in the resistances; but the angle between the ship's track and her fore-and-aft line (course) will give the amount of leeway.

Consideration of these matters shows clearly how necessary it is that the sails when braced sharp up should be set as flat as possible.

There are other questions to be decided, as, for instance, whether, when staysails are carried, there should be much or little after canvas.

The after square sails (if such are in use on a ship) may, in many cases, be reduced with advantage, and the staysails (with the exception of the foretop-mast staysail) may be taken in, as they have a tendency to sag a vessel off to leeward, as also to send a side draught against the square sails, which may interfere with their proper action.

The upper yards do not require such sharp bracing up as the lower yards, on account of their lesser depth of sail; this fact also gives the double topsails and t'gallant sails a great advantage over the

* See Mackenzie's "Practical Mechanics," p. 103, Griffin's *Nautical Series*

old-fashioned deeper sails, which, in a breeze, are often set flat with difficulty.

It is necessary to slack rope gear all round in wet weather ; when it is fine again, all should be hauled taut and the sails properly reset.

BRACING UP AND SQUARING IN.

In light winds each yard should be slightly inside the yard below ; but as the wind grows stronger the difference should be increased by checking in the upper yards.

It is advisable not to brace the yards sharp up unless in narrow channels and smooth water, as on many occasions a point off her course will make little difference in the ultimate course made, but will make a great difference in the speed.

In bracing up, operations should be commenced on the fore-mast, because if this is not done there is a tendency to bring the ship up into the wind, owing to the increased force of the wind on the after-sails. In squaring in, operations should be commenced on the mizen or aftermost mast, because the sails there feel the effect best, and make it easier to trim the forward yards ; it also prevents being caught by the lee, should the wind shift.

In bracing up, the lee lower lifts should be let go, the weather ones hauled well taut, and pulls got of the tacks and sheets of the courses, and sheets of the fore-and-aft sail when the yards are trimmed. Care will be necessary in slacking away the weather braces, particularly if the wind be strong. The officer of the watch should see to this himself, and, if not actually slacking away, should see that a careful hand does it.

In squaring in, the lee braces should be let go, and hauled taut again when the yards are sufficiently in.

TACKING AND WEARING, ETC.

A square-rigged vessel, at her best, can only sail within six points of the wind. Should the wind be blowing from the point towards which she wishes to go, it will be necessary to find means of getting her there. To effect this end, tacking and wearing are resorted to. The actual proximity of the wind's direction to the desired point will generally determine whether tacks shall be long and short, or of equal length.

In ordinary weather, with all plain sail set (plain sail is all square sail with driver or spanker and head sails) tacking is resorted to as it is much more expeditious than wearing ; but in bad weather

wearing has to be adopted, as in the latter operation the strain on the masts, sails, and yards is less. All hands are, as a rule, required for tacking; the men are stationed at different parts of the ship.

In a crew of, say, forty men (the number likely to be carried by the vessel represented in Plate II.) they would be distributed much as follows:

Master on poop or bridge, directing; boatswain and three hands on fore-castle, to work head sails, fore tack, &c, these would also tend the main braces; chief officer and third officer tend the lee main braces; starboard watch on weather main braces; second officer and sailmaker tend lee cross-jack braces; port watch on weather cross-jack braces; cook will tend fore-sheet; the carpenter, engineer, steward and others are generally told off as belonging to a certain watch and work with that watch, after their special duties have been attended to.

Of course, any arrangement of hands can be made for working the ship, always keeping in mind that the operation should be performed as expeditiously as possible, and that as little time as possible should be lost in getting all sail set again.

Having called "*All hands*" and hauled up the cross-jack (and hauled down stays'l's—except foretop-mast stays'l if set) with the watch on deck, who also see all ropes clear for running, haul taut the lee lower lifts and let go weather ones; give the order "*Ready about*," when everybody will fall into their stations. Keep her full for stays (Fig. 33 A), so as to have good way on the ship, then put the helm down, giving at the same time the order "*Hard a-lee*," haul the spanker boom amidships, fore-sheet and head-sheets will then be slacked off, and the ship come rapidly up in the wind. Directly the square sails shiver, give the order "*Tacks and sheets*"; the clews of the courses are lifted, to keep them clear of the rail, when swinging the yards, the bowlines remaining fast until the braces are let go. As soon as she comes up to within a point or a point and a half of the wind (B) give the order "*Mains'l haul*" (if the mains'l is hauled up the order is "*Main-tops'l haul*"), when the after-yards are braced round and sharp up on the new tack. When the wind comes on the other bow (the vessel's head being then at C), the head-sheets are hauled over and hauled aft ready for the new tack. As soon as the wind is about six points on the other bow, as at D, give the order "*Fore-bowline, let go and haul*," when the port head-braces being let go, the fore-yards will fly round on the new tack and the yards be easily trimmed. Tacks (the main tack can be boarded and the sheet got aft if smartly done

just after the yard is swung) and sheets are then hauled down, cross-jack set, and ropes coiled down for running again. If this manœuvre is properly done it should not take longer than ten minutes.

When it is necessary to tack very often, it is a good plan to belay the braces to a certain mark, hauling them in on the bight.

It sometimes happens that a vessel misses stays, that is, refuses to come round after the after-yards are swung ; in this case keep

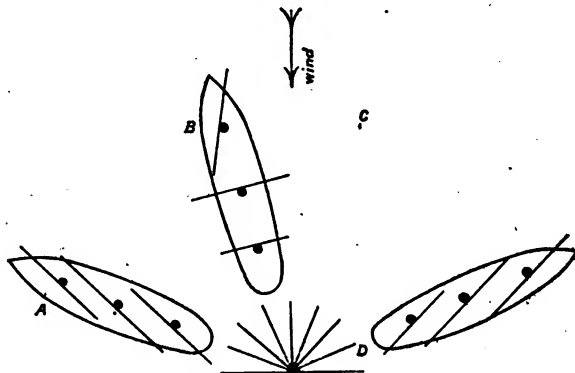


FIG. 33.—TACKING.

- A. Clean full for stays.
- B. Swinging after yards, wind being a little on the starboard side helps to swing them.
- C. Get head sheets over.
- D. On new tack.

the helm down, and, when she has paid off sufficiently, the after-yards can be braced up again on the same tack and the manœuvre tried over again. Or she can be allowed to come round on her heel, which is managed by keeping the helm down, brailing in the spanker, hauling aft fore-sheet and jib-sheets, keeping after-yards square. As soon as she had fallen off enough to fill the after-sails she would gather headway again ; the helm should then be shifted, and as the wind came on the other quarter the head-yards should be braced up for the new tack, and, lastly, the after-yards. In a fresh breeze it is necessary to follow this order, but in a light wind the after-yards can be braced up first.

Wearing.—It is sometimes necessary to wear ship instead of

putting her about. This generally happens when it is blowing hard, or the sea heavy. In this manœuvre the vessel changes tack by going off from the wind instead of coming up into it.

Haul up the after-courses, take in the spanker, and haul the stays'ls (except foretop-mast stays'l), if set, down. Put the helm hard up, and as she pays off square away on the after-yards, keeping these sails just on the shake and thus enable the wind to exert its full force on the for'ard sails. When the wind is aft run the fore-yard square, shift over the head-sheets, and brace up, first the head-yards, next the after-yards on the new tack. If the wind is light the after-yards can be braced up *first*, to help to bring the ship up to the wind.

In wearing ship with a heavy sea on, constant watchfulness is required to save her from the damage which may be done through a sea coming on board.

A fore-and-aft vessel will sail within 4 points of the wind's direction, a square-rigged vessel within 6 points. A vessel when tacking or beating against a dead head wind will make good about one-third the distance actually sailed.

Heaving to.—For picking a man up who has fallen overboard, taking a pilot on board, or for any purpose for which the ship must be stopped, the sails should be disposed so as to stop all way, and yet, at the same time, maintain a more or less fixed position. To obtain this with wind on the quarter, put the helm down and brace up the after-yards, leaving the fore-yards as trimmed, meeting her with the helm as she comes up to the wind, and shortening sail if necessary. With the wind on the beam, or thereabouts, put the helm down, and lay the after-yards square, meeting her with the helm, as before.

Steering Gear.—The apparatus that controls the direction in which the ship is going is the steering apparatus.

It consists of the two primary parts—the rudder and tiller.

A rudder consists of a frame and plating; the upper part forms the rudder head, into which the tiller ships; the lower part is widened out, and the whole is attached to gudgeons on the stern-post, or rudder-post, by means of pintles on the rudder shipping into or on the gudgeons.

The rudder head passes up through the rudder trunk. The latter has a stuffing-box, which serves to keep the rudder steady, and prevents water coming up into the vessel. The head, brought up through the upper deck, has attached to it the arrangement of tiller, quadrants, or arms, whereby to turn the rudder with the wheel.

In the old days the vessels, being small, were steered by

means of a spar fitted into the rudder head, pointing forward, and called the helm, or tiller; from this position of the helm rose the steering terms of port or starboard the helm, rules which are still in vogue, although, in the generality of cases, the tiller is now shipped into the other side of the rudder head. The necessary purchase for moving the rudder is obtained by means of tackles, the ends of which pass round the barrel of a wheel. It is now usual to fit the rudder head with quadrants, to which chains are attached, and in steamers the rudder-chains are worked by a steam-engine,* or by hydraulic gear called a telemotor.

But in all cases the principle is the same; and wherever the tiller, or other appliance, may be fitted, when the order "Port the helm!" is given, it means that the ship's course is to be altered to starboard by placing the rudder over to starboard, and *vice versa*.

The wheel is an apparatus with the principles of the lever applied,† which enables one man to overcome the effect of resistance. As a general rule, the wheel, the rudder, and the ship's head move in the same direction. Some attempts have been made lately to alter this arrangement, but without success, as there seems to be no good reason why the old order should be altered.

The effect of the water on the rudder, when it is turned from the fore-and-aft line in any direction, is to throw the vessel over, away from the pressure of water, the centre of revolution of the whole vessel being about two-thirds forward from the stern.

When the rudder is first moved over, the whole vessel is thrown somewhat to leeward of its original course, and the full action of the water on the rudder is not observed, so far as turning the vessel is concerned, for a few seconds.

The aim of a helmsman should be to move the wheel ‡ as little as possible, and to check any variation from the course by small movements of the helm. Directly a helmsman begins to give much helm the steering becomes very wild, and it is only with difficulty that a steady course can be again attained. In ordinary smooth, fine weather, a modern mail steamer can be kept easily within a degree or two of her course; a cargo vessel and a sailing ship within half a point. In bad weather the variations will be greater. In a sailing ship, when going along "full and by," it is a good plan for the helmsman to keep the weather clew of the mizen-royal just lifting, the officer on watch noting the course made good.

* An Indicator shows always the amount of helm given.

† See Mackenzie's "Practical Mechanics" in Griffin's *Nautical Series*.

‡ The plan practised in the Navy of ordering the helm to be moved so many degrees at a time could with advantage be adopted in the Mercantile Marine.

When the wheel is relieved, the helmsman should give the course to the relieving helmsman clearly and distinctly, and the other should repeat it, so that the officer on watch can hear.

In steamers the action of the water on rudders is somewhat affected by the holes for the propellers, and by the propellers themselves (this, of course, applies chiefly to single screws).

As a general rule, supposing the blade of a propeller to be right-

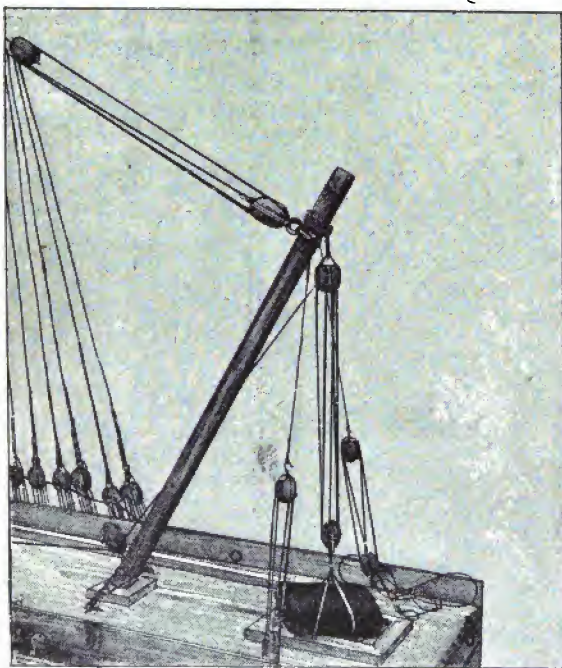


FIG. 34.—RIGGING A DERRICK.

handed, its effect when working will be to throw the stern of the vessel off in the opposite direction to that in which the blades of the propellers are working.

Thus, the bow of a vessel having a right-handed propeller will tend to go starboard, when the vessel is going ahead; and the effect will be the same when she is going astern, the helm not being touched; and *vice versa* with a left-handed screw. But this is

likely to be affected a good deal if the vessel is light, and has parts of its propeller blades out of water, or if the engines are suddenly reversed.

Too much confidence should not be placed in this theoretical action of the propeller, either in going ahead or astern, as it is liable to be much affected by wind and tide, and caution should always be exercised in manœuvring. Nothing but experience can assure a man of the powers of his vessel.

RIGGING DERRICKS OR SHEERS.

Although it is now usual for steamers to be fitted with powerful derricks capable of lifting up to 50 tons or more, it will be necessary

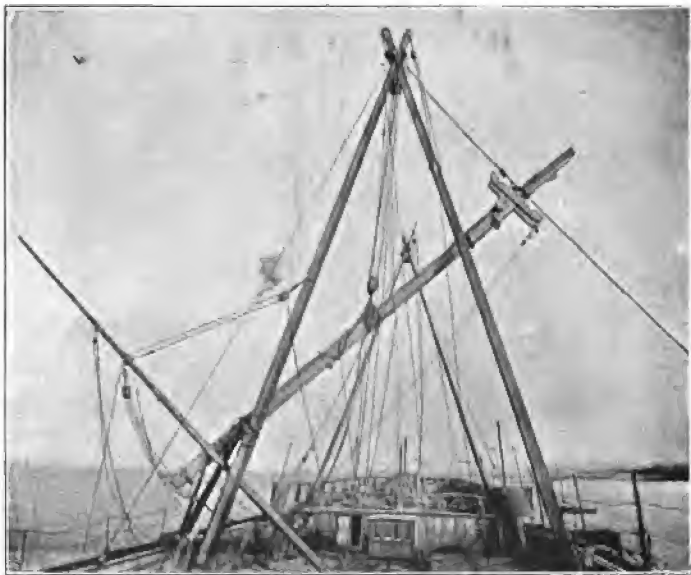


FIG. 35.—LIFTING OUT A MAST WITH SHEERS.

sometimes to rig sheers on board a ship, either for lifting out a heavy weight, such as a boiler, a piece of machinery, or a mast; or for lifting a weight in or out, where yards or fitted derricks are not available.

A single spar will do in some cases, and is called a derrick. All that is necessary is to get the spar on end, placing its base on a

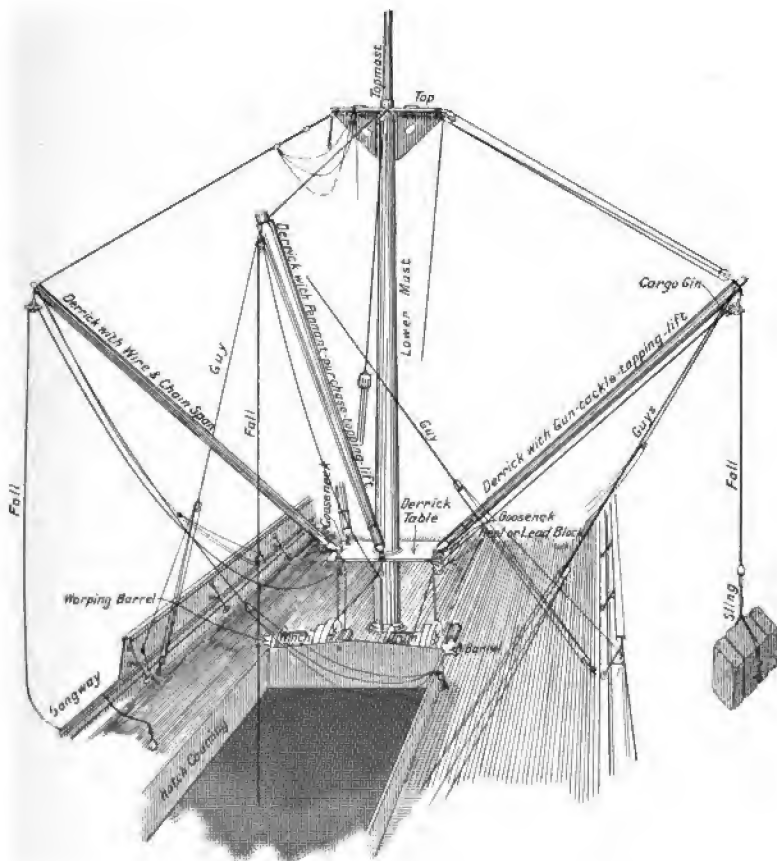


PLATE XIII.—CARGO DERRICKS AND FITTINGS ROUND MAST.

shoe so as to distribute the weight on the deck ; it should be preferably placed over a beam or stanchion, and inclined slightly to plumb the thing to be lifted. It should be securely lashed, the head being held in position by means of guys and tackles. The

upper block of the tackle hangs from the place where the guys are fitted, Fig. 34.

Where this simple form is not available, and when greater strength is required, two spars should be rigged, inclined in manner described, and so fixed that they span the object. In both cases the spars

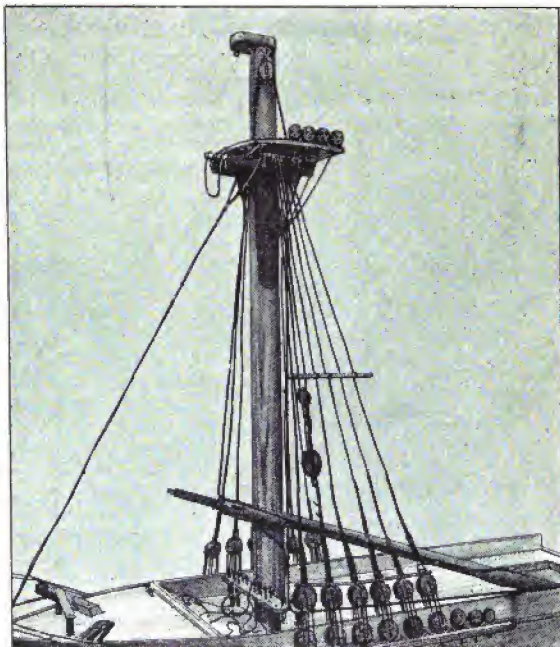


FIG. 36.—SENDING UP A TOPMAST.

are laid on the deck together, a strong lashing is passed round the heads, and the heels are spread out ; *this will tighten up the head ashing* ; the heels are then secured with lashings, as in the other case, on shoes, and the head raised either with a small pair of sheers, such as two handspikes, or by a tackle, to one of the masts.

The lifting tackle is secured over the sheer-leg head-lashing and the whole is well guyed in its place. Fig. 35 represents a mast being lifted out ; on the left will be seen the derrick by means of which it was put overboard.

SENDING UP A TOPMAST, T'GALLANT MAST, ETC.

Suppose a topmast is lying on the port side of the deck head forward, take a large single block aloft, and shackle it on to the

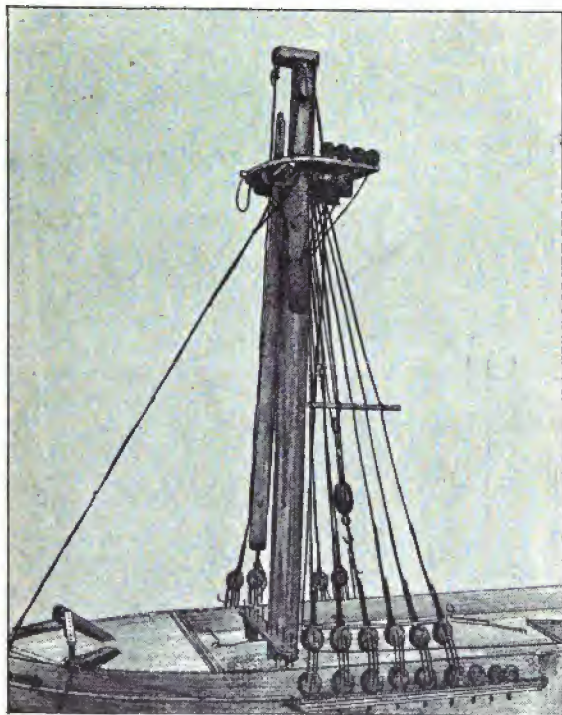


FIG. 37.-SENDING UP A TOPMAST.

port side of the lower cap, where a ring will be found for the purpose. Reeve the mast rope through this block (the size of the rope and block will depend upon the weight of the mast) from aft forward ; bring the end down on deck through the trestle-trees, and reeve it through the sheave-hole in the heel of the mast.

Bring the bight down to the head of the mast, hitch the end round this bight and the mast, then rack the two parts of the mast

rope together, between the head of the mast and the sheave, put a steadying line on the topmast (Fig. 36) and heave away on the mast rope. At sea it would be necessary to have more than one steadying line, and possibly the lower yard would have to be untrussed and unslung, and temporarily secured.

Heave away on the mast rope, and when the head is well pointed

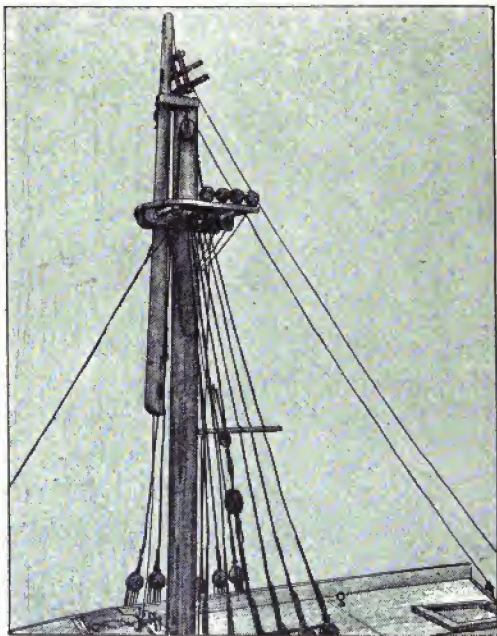


FIG. 38.—SENDING UP A TOPMAST.

through the trestle-trees (Fig. 37), unhitch the end of the mast rope from the head of the mast, and make it fast on to the opposite ring in the cap, then cast off the racking and sway away. As soon as the masthead is pointed through the lower cap, lash a gantline block to the topmast head; and reeve a gantline through it from forward aft; bend this gantline on to the topmast cross-trees, and sway them up on the lower cap, the after-part of the cross-trees resting on the cap, and the fore-part resting against the topmast (Fig. 38). Secure it here with stops to the cap bolts, lower

the topmast, and allow the cross-trees to fall over the topmast head, having first removed the gantline block when the cross-trees are secured. Well tar the mast in the way of the cross-trees, sway away on the mast, until the cross-trees are in their places on the hounds of the mast. Next lash the gantline block to after cross-tree, allowing the block to hang amidships. Tar, parcel, and place the bolsters, then send up the rigging, shrouds, backstays, stays, stay-sail-stays, and strops for the topsail lifts, and place all on, in the order given. Hoist up and place the topmast cap ; sway away the mast, and fix as soon as it is in its place. Set up the stays first, then the backstays ; and, lastly, the shrouds or rigging. A t'gallant and royal mast (which are generally in one piece) are sent up in much the same way ; only as they are lighter the gear can be less heavy. The rigging should be placed on the topmast cap, so that as the mast goes up through, the rigging can be properly placed by a hand on the cap. To prevent the rigging slipping down over the mast, funnels of copper are fitted on the hounds of the royal and t'gallant masts, the stay going first over the funnel, then the shrouds and backstays ; and, lastly, the lift strop. The rigging should be set down on the funnel with a wooden mallet. Besides preventing the rigging cutting into the mast, the funnel holds all the rigging well together. The stays are set up first, then the backstays ; and, last of all, the shrouds.

PART IV—(continued)

D.—FORE-AND-AFT SAILING.

Accidents—Rocket Apparatus—Oil on Water.

ALTHOUGH theoretically governed by the principles of square-rigged vessel sailing, fore-and-aft sailing is practically a distinct branch of seamanship, and as such its outlines will be briefly dealt with in this chapter.

The mainsail is, as the word implies, the most vital part of a cutter's sail plan; in some cases it is the only sail that does not come off her when at anchor. It is therefore necessary that it should be properly bent to the spars. Beneath the jaws, on the under side of the gaff, is an eye-bolt to which the throat cringle at the head of the luff must be shackled or otherwise fastened—the shackle is best for many reasons. The peak of the sail is then carried aft, and the peak earing, which should be spliced on to the peak cringle with a long eye-splice, passed twice or thrice through the eye in the peak of the gaff and the peak cringle; from the latter it is passed four or five times round the gaff end: the end of the earing is then passed between the lower side of the gaff and the cringle, and through the turns which have just been taken round the gaff end. A couple of half-hitches should now be will hardened up in the earing, just aft of the cringle, and the end seized to the eye-splice of the earing itself. If the sail is new, you must avoid getting much purchase on the peak earing, or you will stretch the sail out of shape. If, on the contrary, you are dealing with a sail which has been some time in use, haul well upon the earing so as to stretch the head of the sail, which must now be brought up to the head of the gaff by means of lacing. The usual method is to take a half-hitch at each eyelet-hole, the lacing is thus brought round the yard at a right angle, it holds the sail close and looks neat. The writer, however, is of opinion that a better way is to tie each lacing independently at the eye-holes as follows: pass a lanyard

twice through the eyelet-hole and round the yard, then tie with a reef knot, pass once again round the yard and through the eyelet-hole and tie again, this time close under the gaff, so that it looks neat and the knots are unlikely to be disturbed. The advantage of this method of lacing is that if one lacing gets chafed through, or cut, the others are not affected, and for a while at all events no material harm is done. If a continuous lacing gets cut through, it runs out, and the mainsail must come down, or some one must go aloft to patch up as best he may, a dangerous and difficult job. Another advantage of separate knotting is that if the sail gets wet, and it is necessary to ease up the earing, the fastenings are easily lifted.

The luff of the sail must now be fastened to the mast hoops, which travel up and down the mast with the hoisting of the sail. Various patent attachments exist, but none are better than the old-fashioned lanyard of spun yarn.

The heel of the leech will be hauled out with the traveller, and if the sail is laced to the boom the lacing will now be passed. Continuous lacing will, in most cases, be found sufficient for the foot of the sail where the strain is not very great, and which, moreover, is within reach of repair. In hoisting new sails it is important that no strain be put on head or foot: the topping lifts should take the weight of the boom. New sails should, if at all possible, be kept dry until they have thoroughly shaken into shape in the air. A good plan with the smaller classes of sails is to hoist them on a mast on shore, where they may blow about in the wind and sun. All new sails—mainsail and others—are the better for this treatment.

In setting the mainsail, hook on the peak halliards and mouse the hooks. There is a good American hook which does not necessitate mousing. Overhaul all running gear and see that it is clear. Haul on the weather topping lift until the boom is clear of the crutch, which should be made fast to the deck with a lanyard to secure it from being jerked overboard. Make the main-sheet fast when hauled taut, reeve the peak downhaul and topsail sheet: cast off the tyers and hoist the peak on the clear or lee side of the topping lift so that it goes up clean. Now haul on the throat halliards so that throat and peak go up together about parallel with the deck—if the peak goes up first the throat jams against the mast—when the throat is well up, set up the peak until the sail gets a little at the head of the luff.

The sail is now set, but it will—especially if new or if the gear is new—require constant watching, as it will be sure to slacken up and bag more or less.

It is essential that the luff of all sails should be set as hard as possible, as that is the part which cuts in to the wind, and more than anything else causes the sail to "set like a board" when on a wind. This applies with even greater force to the headsails than to the mainsail. Nothing looks more slovenly than a great curve in the bolt rope of the jib, and nothing is more fatal, as it is all the while dragging the boat's head off the wind.

When sails are set, coil away purchase falls and halliards so that everything may be in place and ready to run clear. In belaying falls and halliards do not be afraid of an extra turn or two on the pin or cleat. Nothing should be so lightly cleated that the strain of the halliard could jam the fall.

If it be necessary to reef your mainsail, bend the reef tackle to the reef earing and hook on the fore block, haul on the weather topping lift, ease up the gaff purchase until the sail comes down all it wants, take the weight of the wind out of the sail with the helm, and harden the earing down on the boom with the reef tackle. In most cases it will be well to make a preventer lashing by passing a tyer two or three times through the reef cringle and round the boom. Now turn in the folded sail at the foot of the leach, roll the "bag" up neatly and tightly, and tie up the reef points. Get the throat and peak purchases again, ease the weather topping lift and cast off the reef tackle; then trim your sheet.

If the reef is to come out again, take the weight of the boom with the topping lift, cast off all the reef points, if one should be left it means work for the sailmaker. Ease away the reef earing and set up the purchases afresh—the throat first—slack away the topping lift and trim.

The most seamanlike manner of setting a jib of any size is to set it in stops. Hook on halliards and downhaul (if the size of the boat necessitates this last), hook the tack on to the traveller and haul handsomely. When the sail is about three-parts up, haul out the tack on the bowsprit, the fore-sheets being loose, until you haul upon them to break out the stops.

Before purchasing up the jib see that the runners are well set up, and give an eye to the bobstay tackle.

Run in the bowsprit before setting the second or third jibs, as much as may be necessary in each case, so that the bobstay takes the strain of the jib tack; if this is not done the traveller will nip and very probably will break the bowsprit. Remember that all, or nearly all the strain of the headsails, topsail, and topmast, and—should the runners not have been looked to when the jib was purchased—the trend aft of the mainmast and mainsail when on a

wind, are thrown upon the bobstay tackle. It is, therefore, necessary that it should be good and strong.

If necessary to shift jibs, do so if possible when off the wind, or run the boat off the wind until the sail is a bit becalmed.

It is easier to set a topsail—especially a gaff topsail—than to describe the process. Bring the topsail sheet, which is already rove at the gaff end, inside the topping lift, and pass it under the yard before bending it on. Make the clewline fast, hook on the halliards and bend trip halliards if the yard is long enough to require them; mouse all hooks.

Send your topsail up to windward, shifting the halliard and sheets should they be to leeward. Get the peak well up inside the topping lift, then hoist away, keeping a slight strain on the sheet to prevent it fouling as the sail goes up. Get the yard up to the trip halliard sheave, and then hoist by the other halliards and belay. Bowse down the tack hard, make taut the trip halliards and trim the sheet.

In lowering a gaff topsail, when it blows, rally it down pretty smartly by the tack, otherwise it will be mixed up with the peak halliards and be difficult to get. It is best lowered to windward, for several reasons; first, because the hands are up to windward, and again because the sail and yard are not so likely to foul the rigging and cross-trees.

When sending out a spinnaker see the halliards all clear on the fore side of the spinnaker topping lift. Bend on the halliards and outhaul, bend on the sheet and belay inside the lee rigging, but loosely, and if possible have a hand to watch that it does not foul and break out the sail, which, except in the most favourable weather, should be sent up in stops. Many a race has been lost because of a fouled spinnaker. Now hoist away, and when it is at the boom end break out the stops, rallying in the sheet pretty smartly afterwards until nearly home. In getting a spinnaker in, be smart with the foot the moment the outhaul is let go, and do not lower away the halliard until the foot of the sail is inboard.

To ease the boat when it is blowing hard it will be sufficient to lower the topmast and hoist the second jib, without reefing, and this more especially when much windward work is in view; that naked pole above the cross-trees is a greater impediment in a hard thrash than most people realise. If it be blowing so hard that the topmast will not house readily, let a hand take the weight off it with the weather backstay and keep it in line with the mast. In the case of a heavy spar, two hands are required for the work.

In getting under weigh, pay the vessel's head off by hauling the

jib up to windward, and put the helm out to port or to starboard as may be required, then trim the sheets until the boat is doing her best on her course. Unless a boat is quickly away it will be found useful to sail her a wee bit full for a few seconds, so as to give her her speed at once.

To go about from one tack to another, see your main- and fore-sheets clear, and let the helmsman call, "Helm a-lee" as he puts the helm down. (In the keen sailing on our inland waters the cry of "Lee-oh" is the equivalent signal. It is shorter and more easily pronounced.) As the vessel comes up into the wind her headsails lift. Ease away the sheets until they just show signs of filling on the other tack, then ease them home and belay. Some boats are best sailed pretty full for a length or two before coming about. As has already been said, there is almost an advantage in sailing them a little full for the first second or two of the new tack; to starve a boat round and then pinch her up in the wind at the commencement of the board is generally a fatal mistake. The old cutters with their deep forefoot and dead wood aft required boxing off with foresail, or jib, ~~of both, but in modern~~ craft, ninety-nine times out of a hundred ~~nothing but~~ ^{but} bad seamanship requires such help.

Good handling of the jib and foresail ~~sheets are at this stage~~ ^{are at this stage} most essential, if badly tended they easily drag a boat's head off the wind. When a boat "misses stays" the fault is as often that of the forward hands as it is of the helmsman.

In going about, in gybing or wearing, the hands at the runners must be smart; care must be taken that the boom does not take charge. Present-day boats are not nice to "lay-to" in. Some are supposed to be hove-to best under the foresail, but this must require ceaseless attention from the helmsman; there are few cases in which the trysail would not be more effective. The safest and easiest course for such vessels in severe weather seems to be to lie to a sea anchor with their sails down on deck, with the exception, perhaps, of the mizen stormsail. A good floating anchor may be extemporised with a pail and a life-buoy. The pail is slung securely some four or six feet beneath the life-buoy and on its side, so that its mouth is opposed to the drag of the boat. Line which has been bent on to the handle of the pail is then paid out; another and lighter line being secured to the buoy. A spare spar with a line bent to it is a simpler but less effective method.

The usual fault of the novice at the helm is that he gives too much of it and shifts too often, so that his ship is either off the wind or starved up in its eye. The helmsman should have his

position as far as possible up to windward, so that he may see what his headsails are doing ; they should be his chief guide, the racing flag or the vane are misleading, and the luff of the mainsail is apt to lift with the eddy thrown into it from the foresail. The wind outside the boat must be watched, and approaching puffs and slammers negotiated easily and firmly. A modern boat luffs up of herself with a little easing of the tiller if the forward sheet hands are doing their work properly.

In sailing " off the wind "—that is, running more or less before it—still greater care is requisite in a heavy sea. The helm must be carefully watched to prevent the boat yawing about as the headsails lift occasionally, or the wind suddenly draws abeam and pays her head off. It is easier and better for the boat to accommodate her to the variations of the wind by the helm than by a constant trimming of the sheets, though this applies more, perhaps, to the mainsail than to the headsails.

In Match Sailing it is essential that the sailing master should be thoroughly acquainted with the rules and regulations of the particular Association under whose auspices the race he is engaged in is being sailed. Carelessness in this matter is the cause of much contravention of regulation, and of many subsequent disputes and protests. Accurate knowledge of the course to be sailed is another important point, so are acquaintance with the signals : on which hand to leave buoys, &c. If the issued instructions are insufficient, the competitor should go to the Sailing Committee and have his doubts cleared up before he starts. In match sailing, each hand should know his place and exactly what duty he is to perform.

Starting. Flying starts are the rule nowadays, no part of the yacht or her equipment may be on the line before the starting gun fires. Wind and tide, or wind against tide, should be so worked that the yacht may cross the line at her best speed, and in the weather berth if possible, immediately on gunfire. That is the ideal start. Should the boat be found too near the line she must be deadened on her way by hauling the headsails up to windward, or running off the mainsail, or both, if on a wind. If off the wind, get the mainsail in, being careful to watch the helm so that the mainsail may be on the right gybe when the main-sheet is run off again. If the yacht be caught over the line on gunfire, she must keep clear of all other boats that have crossed or are crossing as she returns to start again. The starting and finishing buoys may be fouled with impunity * at start or finish, though it is a clumsy

* This applies only to " up river " racing.

PICCOLO (36-foot L.R.*).

PLATE XIV.

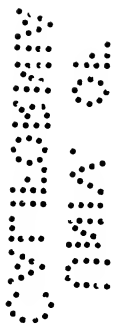
PHALOROPE (24-foot L.R.*).



MAGDALEN and BALAENA (52-foot L.R.*).

SORAIS II. (30-foot L.R.*).

* L.R. = linear rating.



thing to do, but at all other times in the race, all buoys in the course are "marks in the course," and to foul any one of them, however



FIG. 39.—STANDING LUG RIG.



FIG. 40.—SLIDING GUNTER RIG.

slightly, with any part of the yacht or her gear means disqualification. It is not always a disadvantage to cross the line in the rearmost berth in a crowded start, the other boats get in a bunch

and blanket one another, or the two cracks may engage in a luffing match, and one sometimes finds oneself free to pick out a very comfortable situation. Luffing matches are a mistake. In fact, on all points of sailing it is best to sail a generous race; if you are known to do so every one will not watch to catch you tripping, and you will find opportunities to give and take that will add to, not take from, the charm of yachting.

HANDLING OF BOATS UNDER SAIL.

Boat Sailing is an art that deep-water sailors have little opportunity of practising; and yet there is always a possibility that in the event of a ship being lost at sea, the only means of getting to land will be by sailing the boats there, should any of these escape destruction. Bearing this in mind, it is well that all sailors should have experience in boat sailing, and should endeavour to improve their knowledge whenever opportunity may arise. Long stays in foreign ports at some distance from the land afford good occasion for practising, and this practice forms a most useful introduction to the art of sailing.

The handiest rig for a ship's boat is probably the dipping lug. All boats should be fitted with masts and sails, but this does not prevent any other rig being fitted to one particular boat.

For the purpose of constantly running between the ship and the shore, possibly a sprit or cutter rig will commend itself.

Barécas are the best ballast for a sailing boat. Should an accident occur they will not tend to sink a boat as will sand ballast or pig-iron, because they are filled with water having a less specific gravity than the sea water outside. When a boat has to be away some time, the fresh water in the barécas can be used if necessary and replaced with salt water. The barécas should be three-quarters filled and should be fixed by lashings amidships.

It is most important that the trim of the boat should be carefully attended to, as upon this the boat's manner of sailing, particularly when on a wind, will in a great measure depend.

The crew should always sit down in the bottom of the boat, and nothing should be allowed over the gunwale, such as oars or rowlocks. The sheet of the sail should never be belayed on any consideration, but should be held so as to allow of its being let go on the instant, should necessity arise. It is better to unship the mast than to attempt to do anything to it by climbing up when shipped.

A place for baling should always be left clear.

The most dangerous position for a boat to be in is sailing with the wind and a heavy sea on the beam. In such a case it is better to sail the boat up to windward part of the way, and then to bring the wind and sea on the quarter for the rest of the way.

Sail should be reduced directly the boat begins to wet. The tack of a dipping lug is hooked to the stem * and in tacking the forward yard-arm is dipped round the mast.

When going about, the sail should be lowered just enough to



FIG. 41.—LIFE-BOAT FITTED WITH DIPPING LUG.

dip the forward yard-arm and tack round the mast; this should be done smartly. If caught in a squall, ease the sheet; if in a hard squall, put the helm down, let fly the sheet, and lower away the sail. Fig. 41 shows a life-boat with a dipping lug.

SEA ANCHORS FOR BOATS.

Boats are now generally fitted with small patent sea anchors of various forms, but several oars lashed together, or the yard

In running, should be hooked to the bow.

with sail adrift on it, make fairly good sea anchors to which a boat may ride in a heavy sea. They can be attached to the painter or line.

LOWERING A BOAT AT SEA.

Before lowering a boat (a lee boat) at sea the painter should be passed inboard forward, the outboard rowlocks shipped, and plugs inserted in their places; the hands should take hold of the life-lines while the boat is being lowered, and the oars should be ready for instant use.

In high-sided vessels it is a very useful plan to have up and down the ship's side a wire guy on which is fitted a lizard; the end of this is held in the boat during lowering or hoisting, and keeps the boat from banging about if the vessel is rolling.

LANDING ON A BEACH.

Landing on a surf-bound coast is always a perilous operation, and one that requires great skill and coolness.

In some cases the breakers extend some distance from the shore and a regular gauntlet is run with the waves; in others, the sea breaks immediately on the beach itself.

It must be remembered that it is difficult, on account of the curling of the waves, to tell the true state of the surf from the seaward side, so that every precaution should be taken in beaching a boat.

Bear in mind that the sea breaks because the shallowness of the water causes the top part of the waves to fall over. Herein lies the boat's danger.

A boat going in on a wave will have the bow depressed, the velocity of the wave crest may force it under, or if it cants the stern in the least, on one side or the other, it may capsize. To avoid this the boat should either be backed in, stern first, or a drogue should be fitted, hanging to the stern, which will have the effect of keeping the boat from being driven forward too rapidly. Besides these precautions extreme vigilance and skill are essential in handling the boat.

If it is merely intended to land one or two of the crew, it is well to anchor the boat, and veer her close to the beach, then the hands can jump out and the boat be hauled off immediately.

In making way out through a surf, equal skill is required; unless way can be kept on the boat, she will probably be thrown broadside on and capsized.

ACCIDENTS, ETC.

Man overboard !—The saving of a man's life in this emergency often depends entirely upon the officer on watch keeping a cool head. Put the helm down and heave the ship to, turning the hands out at the same time. Throw a life-buoy, or anything that will float, to the man in the water ; if it be dark, throw a patent light as well, and send a man aloft to keep an eye on him, or he may be easily lost sight of. Man, and send away the lee boat. The officer in charge of the operations should never go into the boat, unless relieved, as he can do more good by manœuvring the ship, so as to pick the boat up again, than by going in the boat.

On no account should a man be left, so long as there is any chance of his being still afloat. It must be remembered that a man can live many hours in the water.

When this accident happens on a *steamer*, go full speed astern, and stop the ship as quickly as possible, taking care to keep the propeller clear of the man.

Life-buoys should be placed about the ship in handy positions, on brackets or hooks, so as to be detachable at once.

If a man falls overboard in a heavy gale, when it would be impossible to lower a boat, he may be picked up by making a smooth for him with the ship, and oiling the water, but this is a manœuvre that requires experience.

RESTORING THE APPARENTLY DROWNED.

In view of the numerous accidents which have already occurred during the present bathing season, Mr. William Henry, chief secretary of the Royal Life Saving Society, 8, Bayley Street, Bedford Square, W.C., writes to suggest a more general practising of the art of life-saving. He says, in the course of his letter : " The new method of restoring the apparently dead, either from drowning, suffocation, or electrical shock, devised by Professor Schäfer, of Edinburgh University, is extremely simple and easy to learn. It is conducted as follows : (1) Immediately a person is lifted out of the water, lose no time in attempting artificial respiration, as every instant of delay is serious ; (2) If breathing has ceased, place the patient face downwards, and turn the face either to the right or left, so that the mouth and nose do not touch the ground ; (3) Place yourself at the side of the patient, in a kneeling position facing his head, with your hands flat in the small of his back, the thumbs nearly touching, and the fingers spread out on each side

of the body over the lowest ribs ; (4) Lean forward over the patient and steadily produce a firm downward pressure, which must not be violent. Next release all pressure by swinging backward without lifting the hands from the body ; (5) Repeat this pressure and relaxation of pressure every four or five seconds without any marked pause between the movements, until natural respiration is resumed. Note.—When the downward pressure is applied, the foul air in the lung is pressed out, and, immediately pressure is released, fresh air takes its place. In this way, an exchange of air is effected in the lungs by artificial means similar to the way in which we breathe naturally ; (6) When natural breathing is established, cease the pressure and non-pressure movements, turn the patient face upwards and immediately promote warmth by friction over the surface of the body. As soon as possible remove the patient to the nearest house, put him to bed, and apply heated flannels, water-bottles, &c., to various parts of the body. See that the room is well ventilated and prevent persons crowding round. In all cases send for medical assistance as soon as possible."

ACCIDENTS TO SAILS AND SPARS.

The Sheet of a Square Sail carried away.—Haul up on the clewline and buntlines ; then lower the yard (if an upper yard or a royal), haul taut the weather brace, but do not lower until the gear is hauled up, as by keeping the yard up there is less to knock about ; repair the sheet and reset the sail.

Downhaul of a Jib carried away.—Give the ship a wipe off, so as to calm the sail, and send hands out to haul it down by hand ; if the weather be too bad for this, set sail again, and take a line up before all, make a bowline on the stay, and use it as a downhaul.

Brace carried away.—Keep ship off before the wind, take in sail (if necessary), and repair the damage.

Sheet of Head Sail carried away.—Run the ship off a point or two, and haul sail down as quickly as possible ; bend new sheet, and reset the sail.

If a parrel is carried away, or comes adrift, lay the sail aback, thereby binding the yard to the mast, and fit another parrel.

If a spar is carried away aloft, it will be necessary at once to secure any other spars or braces that depend upon it for support, and also to get the broken spars down from aloft as quickly as possible, since, if allowed to bang about, they may do much damage. It is a very useful precaution to have a line always handy, especially in bad weather ; this can be taken aloft at once, and used

as a gantline (without the necessity of opening hatches) for lowering down the damaged spars.

If any of the spars hang over the side, and endanger the safety of the ship by banging against her side, and should the weather be too bad to save them, they should at once be cut away.

If the Lower Lift is carried away, and with it probably the top-sail sheet, secure the topsail, brace the lower yard against the rigging, reeve new lift, and reset the sails.

If a yard gets sprung it may be repaired by fishing—that is, placing pieces of wood round the wounded part, securing them with wire or chain lashing, and well wedging all up when finished.

Taken aback.—It is very seldom that a watchful officer will be taken aback; but should this happen, the ship must be prevented from getting sternway, as, if the sea is bad, the results of sternway are likely to be disastrous. Suppose the ship is going along with the wind on the port quarter, and she is taken aback with the wind on the starboard beam, the head-yards should be hauled round at once, on the starboard tack, then the after-yards, attention being paid to the way in which the helm is put. If the wind suddenly shifts from the port beam to the starboard bow, put the helm down, brace round the after-yards, then the head-yards, and bring her to her course again.

A sudden hard Squall strikes the Ship.—If the wind is before the beam, luff up to it, and shake it out of her; if abaft the beam, up helm and wipe her off a point or two. It is very dangerous to try to get the ship off the wind, if the wind is before the beam, unless the squall gives sufficient warning before it strikes the ship, as, owing to the ship lying over so much, the rudder has little power, and yards will not come down when the halliards are let go, the great inclination of the masts as she lies over preventing the yards running down.

INSTRUCTIONS FOR THE GUIDANCE OF MASTERS AND SEAMEN WHEN USING THE MORTAR AND ROCKET LINES FOR SAVING LIFE FROM SHIPWRECK.

In the event of your Vessel stranding on the Coasts of the United Kingdom, and the lives of the crew being placed in danger, assistance will, if possible, be rendered from the shore in the following manner, namely:

1. A rocket or shot, with a thin line attached, will be fired across your vessel. Get hold of this line as soon as you can; and when you have secured it, let one of the crew be separated from the rest, and **IF IN THE DAY-TIME**, wave his hat or his hand, or a flag or handkerchief; or, **IF AT NIGHT**, let a rocket, a blue light, or a gun be fired, or let a light be waved as a signal to those on shore.

2. When you see one of the men on shore separated from the rest, wave a **RED FLAG**; or, if at night, wave a **RED LIGHT**; you are to haul upon the **ROCKET LINE** until you get a tailed block with an endless fall rove through it.

3. Make the tail of the block fast to the mast about 15 **FEET ABOVE THE DECK**, or, if your masts are gone, to the **HIGHEST SECURE** part of the vessel; and when the tailed block is made fast, and the **ROCKET LINE UNBENT FROM THE WHIP**, let one of the crew, separated from the rest, make the signal required by Article 1 above.

4. As soon as the signal is seen on shore, a hawser will be bent to the whip line, and will be hauled off to the ship by those on shore.

5. When the hawser is got on board, the crew should at once make it fast to the same part of the ship as the tailed block is made fast to, only about 18 **INCHES HIGHER**, taking care that there are **NO TURNS OF THE WHIP LINE ROUND THE HAWSER**.

6. When the hawser has been made fast on board, the signal directed by Article 1 above is to be repeated.

7. The men on shore will then pull the hawser taut; and, by means of the whip line, will haul off to the ship a sling, cot, or life-buoy, into which the person to be hauled ashore is to get and be made fast. When he is in and secure, one of the crew must be separated from the rest, and again signal to the shore as directed in Article 1 above. The people on shore will then haul the person in the sling to the shore; and, when he has landed, will haul back the empty sling to the ship for others. This operation will be repeated to and fro until all persons are hauled ashore from the wrecked vessel.

8. It may sometimes happen that the state of the weather and the condition of the ship will not admit of a hawser being set up; in such cases a sling or life-buoy will be hauled off instead; and the persons to be rescued will be hauled through the surf instead of along the hawser.

Masters and crews of stranded vessels should bear in mind that success in landing them, in a great measure, depends upon their coolness and attention to the rules here laid down, and that by attending to them many lives are annually saved by the mortar and rocket apparatus on the coasts of the United Kingdom.

The system of signalling must be strictly adhered to; and all women, children, passengers, and helpless persons should be landed before the crew of the ship.—**BOARD OF TRADE**.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING SEAS.

The Board of Trade calls the attention of officers to the fact "that a very small quantity of oil, skilfully applied, may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of broken or troubled waters." The principal facts as to the use of oil are as follows:

1. On free waves—i.e., waves in deep water—the effect is greatest.
2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain; as nothing can prevent the larger waves from breaking under such circumstances; but even here it is of some service.

3. The heaviest and thickest oils are most effectual. ~~Refined kerosene~~

is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, both when running or lying-to, or in wearing.

6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and injury to the boat would be saved by its application on such occasions.

7. In cold water, the oil, being thickened by the lower temperature, and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. The best method of application in a ship at sea appears to be: hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such bags being pricked with a sail needle to facilitate leakage of the oil.

The position of these bags should vary with the circumstances. Running before the wind they should be hung on either bow—*e.g.*, from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying-to, the weather bow and another position farther aft seem the best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward while the ship drifts.

9. Crossing the bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances, the effect cannot be so much trusted.

On a bar with the ebb tide it would seem to be useless to try oil for the purpose of entering.

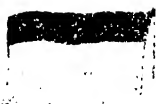
10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.

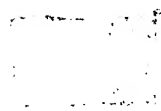
NATIONAL

MERCHANT MARINE

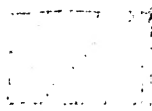
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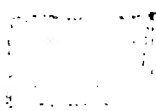
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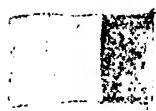
FRANCE



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SWEDEN



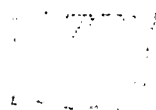
BELGIUM



NORWAY



AUSTRIA



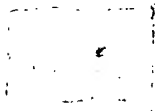
HOLLAND



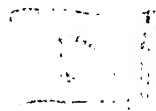
DENMARK



SPAIN



RUSSIA



ITALY



JAPAN



GREECE

MERCHANT NAVY FLAGS

PLATE XXII

NATIONAL
Red Ensign



MERCANTILE MARINE
ENGLISH



NATIONAL
U.S. AMERICA



FRANCE



GERMANY



NORWAY



BELGIUM



SWEDEN



DENMARK



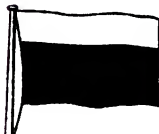
HOLLAND



AUSTRIA



ITALY



RUSSIA



SPAIN



BRAZIL



GREECE



JAPAN

MERCHANT NAVY FLAGS.
Plate XVII.

PART V

SIGNALS AND SIGNALLING—RULE OF THE ROAD.

THE INTERNATIONAL CODE OF SIGNALS.*

THE International Code of Signals for all nations is that in general use: it consists of twenty-seven flags—the letters of the alphabet and one code pennant; of combinations of these all the various signals are composed.†

It is possible to classify the different signals as follows:

ONE-FLAG SIGNALS.

- A. R.N. vessel on full speed trial.
- B. Vessel having it hoisted is taking in or discharging explosives.
- C. Yes.
- D. No.
- P. (Blue Peter) Vessel about to proceed to sea.
- Answering pennant.
- Towing signals.
- S. Want a pilot.

TWO-FLAG SIGNALS.

Urgent and Important Signals.

- (1) Code flag over one flag, as:
Code flag over K = I have sternway.
- (2) Two-flag, A B to Z Y, as:
 - A G = I must abandon the vessel.
 - B R = Man overboard.
 - C M = Am drifting: want assistance.
 - N C = In distress: want immediate assistance.

* For complete particulars see "The International Code of Signals for the Use of all Nations," published under the authority of the Board of Trade.

† Over 375,000 signals can be made with the 26 flags.

THREE-FLAG SIGNALS.

These are general signals, and relate to :

- (1) Compass, A B C to A S T.
- (2) Money, A S U to A V J.
- (3) Measures and Weights, A V K to B C N.
- (4) Decimals and fractions, B C O to B D Z.
- (5) Auxiliary phrases, B E A to C W T.
- (6) General vocabulary, C X A to Z N P.
- (7) Latitude and longitude, time, barometer and thermometer :
code flag *over* two flags, A B to Z Y.
- (8) Numeral table code flag *under* two flags, U A to Z Y.

FOUR-FLAG SIGNALS.

- (1) Geographical signals, A B C D to B F A U.
- (2) Alphabetical spelling table, C B D F to C Z Y X.
Names of men-of-war with the pennant G uppermost.
Names of merchant ships with a square flag uppermost.

All the flags can now be used directly, but no more than four must be in one hoist.

Signalling should be conducted smartly. Double halliards should always be fitted to the gaff end, which, when not in use, should be made fast to the tack of the driver or spanker, or in a steamer to the signal stay over the bridge ; and the signal locker should be close at hand. When much signalling is being done, a board with hooks for each flag is very convenient.

DISTRESS SIGNALS.***DAY.**

- (1) A continuous sounding with any fog-signal apparatus.
- (2) Code signal N C.
- (3) The distant signal, a square flag with a ball above or below it, or a cone pointing *upwards* with a ball above or below it.
- (4) A gun or explosive signal fired at intervals of about a minute.

NIGHT.

- (1) A continuous sounding with any fog-signal apparatus.
- (2) Flames from a burning tar-barrel or other inflammable stuff.
- (3) A gun or explosive signal fired at intervals of about a minute, or rockets or shells fired at short intervals.

* Persons wrongly using these signals are subject to heavy penalties.

PILOT SIGNALS.

DAY.

- (1) Pilot jack at the fore.
- (2) Code signal P T.
- (3) Code signal S, with or without the code pennant over it.
- (4) The distant signal, a cone point *upwards*, having two balls above it. (A pilot's boat when afloat will carry the pilot-boat's flag.)

NIGHT.

- (1) A blue light every fifteen minutes.
- (2) A white light flashed or shown at short and frequent intervals just above the bulwarks for about a minute at a time.

WRECK SIGNAL.

A square green flag with wreck printed in it.

SIGNALS AND SIGNALLING.

Signals of various kinds are used by ships to communicate with another vessel out of hailing distance.

(1) **Daylight Signalling** is conducted by means of sets of coloured flags. By a single flag using Morse Code. By various shapes for distant signalling. By flags or movable arms fitted to a mast and worked by levers, called semaphore; or by sound (whistle or syren using Morse Code).

(2) **Night Signalling** * is conducted by means of a flashing lamp, and with Morse or other code, and by sound signals.

Until quite recently coloured flags alone were used, but the rapid movement of steamers and the necessity of communicating quickly, both by day and night, has brought the Morse Code into use. It will probably in time supersede the other methods of signalling for ordinary purposes. A great advantage in favour of the Morse Code is its adaptability for either day or night signalling (by flashes of light or sound) and the convenience with which it may be used when away in boats, or on land. Etheric telegraphy and telephony will eventually supersede these methods.†

* Many steamship companies have private night signals.

† Its great use was demonstrated recently in the rescue of the passengers from the *Republic* after collision.

GENERAL ALPHABETICAL TABLE FOR MAKING THE INTERNATIONAL CODE SIGNALS BY MEANS OF DISTANT SIGNALS BY SHAPES.				
<i>Preparative "Answering"</i> <i>"Stop" after each complete signal</i>		<i>Answer the whole Signal</i>		
A 1 1 2	I 2 1 2	Q 2 3 3	Y 3 2 3	
B 1 2 1	J 2 1 3	R 2 3 4	Z 3 3 4	
C 1 2 2	K 2 1 4	S 2 4 1	SPECIAL SIGNS	
D 1 2 3	L 2 2 1	T 2 4 2	Code Flag Sign 4 2 1	
E 1 2 4	M 2 2 3	U 2 4 3	Alphabetical Sign 4 2 2	
F 1 3 2	N 2 2 4	V 3 1 2	Numerical Sign 4 2 3	
G 1 4 2	O 2 3 1	W 3 2 1	Finishing Sign after completion of word or number, when 4 3 2 spelling, or making numerical signal	
H 2 1 1	P 2 3 2	X 3 2 2		
If no Cones are available, a square Flag may be substituted for the Cones point upwards, a Pennant for the Cone point downwards, and a whet for the Drum.				

PLATE XV.—DISTANT SIGNALS.
















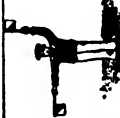









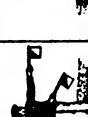


						
A or 1	B or 2	C or 3	D or 4	E or 5	F or 6	G or 7
						
H or 8	I or 9	J (also Alphabetical Sign)	K or O (Numerical)	L	M	N
						
O	P	Q	R	S	T	U
						
V	W	X	Y	Z	Alphabetical.	Numeral.
						Annul.

PLATE XVI.—SEMAPHORE BY HAND FLAGS.

SAILING SIGNAL.

Blue Peter at the fore.

MORSE ODE.

The Morse Code is rapidly coming into favour on account of the ease with which it can be communicated either by sight or sound. For signalling by sight in the daytime, a flag on a short staff is used. The signaller can stand in any position he likes, having due regard to the ease with which the person he is signalling to can read his signals. In the daytime for a dot (·) the flag or staff should be moved smartly across the body from one shoulder to the other, describing an arc of about 50°; for a dash (-) it should be moved from one shoulder over the opposite side of the body, making an arc of 150°, the flag being held all the time well above the head.

At the end of each word push the flag up perpendicularly over the head. In using the lamp at night time, see that you point the lamp correctly. The length of the exposure of the light for the dash (-) should be three times as long as that for the dot (·); make a slightly longer pause at the end of each word.

The Morse Code must be learnt by every young sailor; it offers an expeditious and easy method of signalling not only by day, but also at night, but to attain perfection constant practice is necessary.

SIGNALLING WITH WARSHIPS.

While the International and Morse Codes are practically in universal use, a complete system of signalling has recently been authorised for use between British Warships and Merchantmen, and a special explanatory pamphlet † of instructions issued.

* The Board of Trade has recently sanctioned the use of a special warning signal for use at night time. It is the letter **U** of the Morse Alphabet (. . -), and indicates "You are standing into danger."

† *The British Signal Manual for Use between H.M. Ships and British Merchant Vessels.* 1s.

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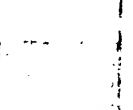
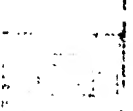
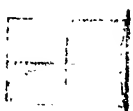
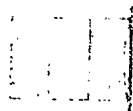
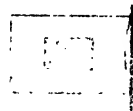
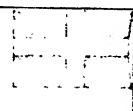
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Figure 1
a Plot



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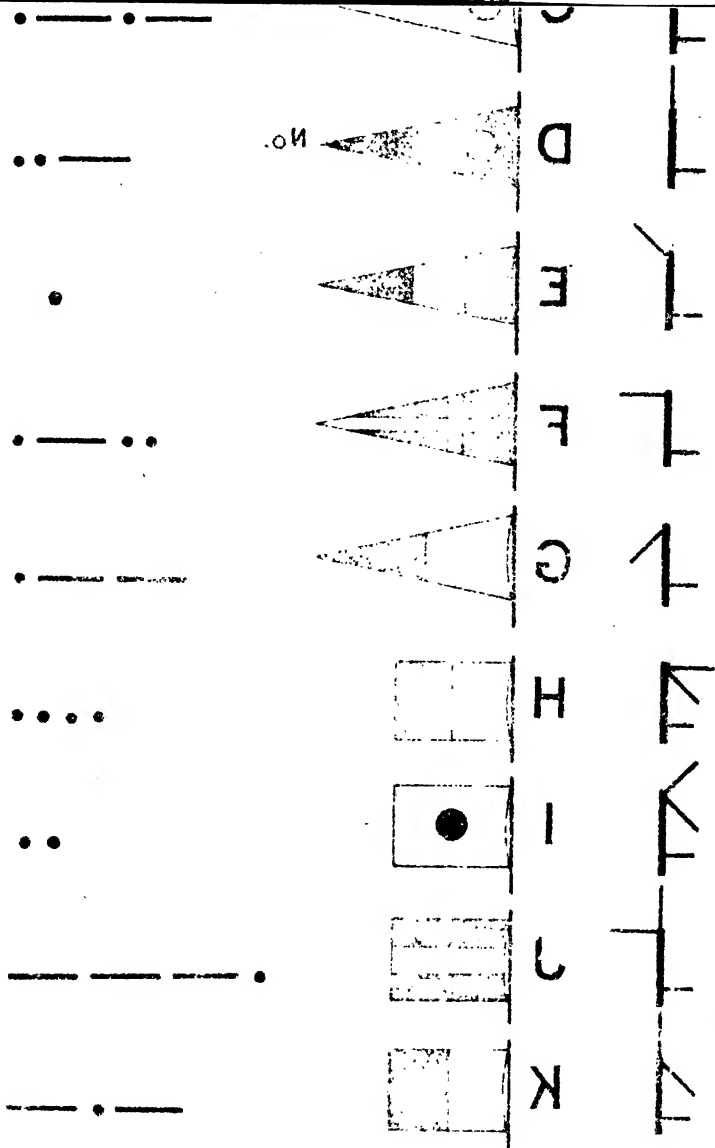
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DATE: 11/11/11

Blue Eagle

1961-1962

1. *Chlorophyll a* (Chl a) is the primary photosynthetic pigment in most plants and algae. It is a green pigment that absorbs light energy in the blue and red regions of the visible spectrum.

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1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

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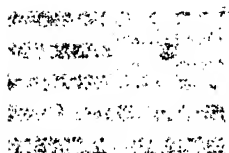
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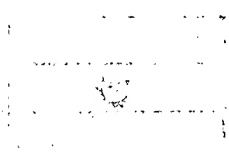
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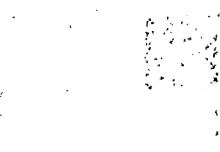
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DOMINICAN REPUBLIC



ARGENTINE REPUBLIC



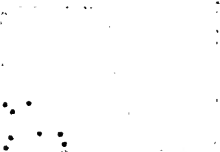
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JAPAN



CHINA

SIR CHARLES WHEATSTONE'S MORSE TABLE.

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DIPPING THE ENSIGN.

Dipping the Ensign, as the action is called, whereby one ship salutes another, consists in slowly hauling the ensign down the staff, or from the peak, about half-way, and then after a slight pause hoisting it again slowly, taking care at the same time that the halliards are kept taut.

It is difficult to lay down any hard-and-fast rules for the guidance of officers, but it may be generally considered that :

1. A junior dips first to a senior.
2. A merchant ship dips to a man-of-war. (In the case of a squadron to the flagship.)
3. The flags should be dipped when the ships are abreast, the vessel taking the initiative making a slightly longer pause in order to give the other vessel a chance of answering.

It is customary now to make only one dip.

A flag should be hoisted close up to the truck and the halliards kept tight.

DIAGRAMS FOR PRACTISING THE RULES OF THE ROAD.

The student is advised to cut out these little diagrams (on Plate XX.), mount them on stiff card and colour the side light areas. He can then devise combinations of vessels, steamers and sailing

vessels, or sailing vessels alone, the arrow giving the direction of the wind. A little tiller can be added to each to show how the helm is.

Exercises with these little models and a compass will be found very informing. Colour indicated on one diagram as an example.

RULES OF THE ROAD.

The Rule of the Road has been formulated to enable vessels to navigate the sea expeditiously and safely, without coming into collision; it has been elaborated from a few rules accepted by custom and dating from the early days of sailing ships.

These rules shall be followed by all vessels upon the high seas and in all waters connected therewith, navigable by sea-going vessels.

In the following Rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The word "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way" within the meaning of these Rules, when she is not at anchor, or made fast to the shore or aground.

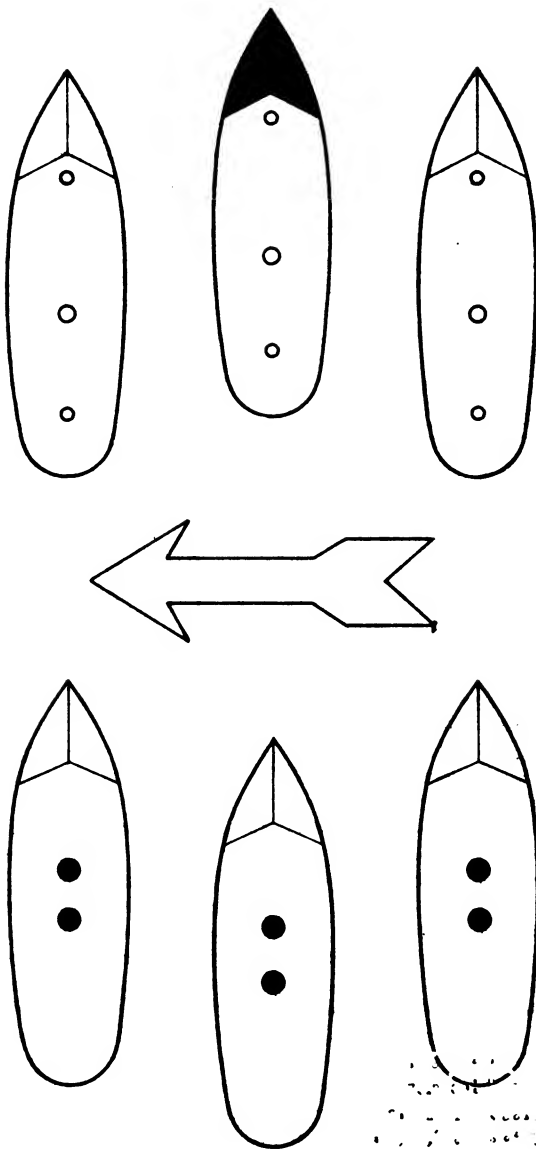
RULES CONCERNING LIGHTS, ETC.

The word "visible" in these Rules, when applied to lights, shall mean visible on a dark night with a clear atmosphere.

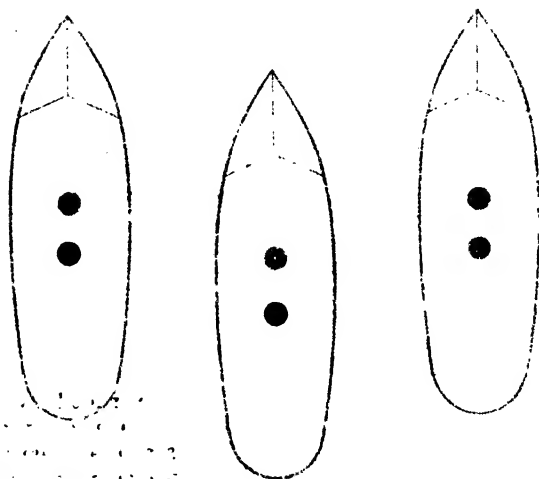
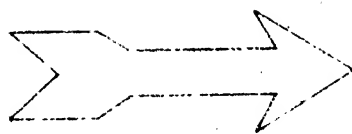
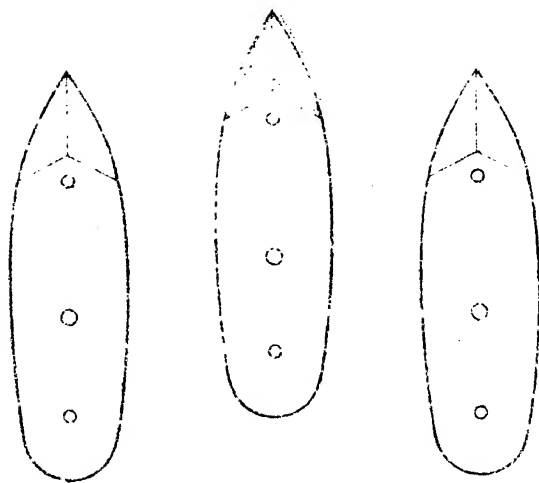
Article 1. The Rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

Article 2. A steam vessel when under way shall carry—

(a) On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel, at a height above the hull of not less than 20 feet, and if the breadth of the vessel exceeds 20 feet, then at a height above the hull not less than such breadth, so, however, that the light need not be carried at a greater height above the hull than 40 feet, a bright white light, so constructed as to show an unbroken light over an arc of the horizon of 20 points of the compass, so fixed as to throw the light 10 points on each side of the vessel, viz., from right ahead to 2 points abaft the beam on either side, and of such a character as to be visible at a distance of at least 5 miles.



DIAGRAMS FOR PRACTISING THE RULES OF THE ROAD.
Plate XX.



DIAGRAMS FOR PRACTISING THE RULES OF THE ROAD.

Plate XX.

Digitized by Google

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of 10 points of the compass, so fixed as to throw the light from right ahead to 2 points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least 2 miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of 10 points of the compass, so fixed as to throw the light from right ahead to 2 points abaft the beam on the port side, and of such a character as to be visible at a distance of at least 2 miles.

(d) The said green and red side-lights shall be fitted with inboard screens projecting at least 3 feet forward from the light, so as to prevent these lights from being seen across the bow.

(e) A steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least 15 feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

Article 3. A steam vessel when towing another vessel shall, in addition to her side-lights, carry two bright white lights in a vertical line one over the other, not less than six feet apart, and when towing more than one vessel shall carry an additional bright white light 6 feet above or below such lights, if the length of the tow, measuring from the stern of the towing vessel to the stern of the last vessel towed, exceeds 600 feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in Article 2 (a), except the additional light, which may be carried at a height of not less than 14 feet above the hull.

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

Article 4. (a) A vessel which from any accident is not under command shall carry at the same height as the white light mentioned in Article 2 (a), where they can best be seen, and, if a steam vessel, in lieu of that light, two red lights, in a vertical line one over the other, not less than six feet apart, and of such a character as to be visible all round the horizon at a distance of at least 2 miles ; and shall by day carry in a vertical line one over the other not

less than 6 feet apart, where they can best be seen, two black balls or shapes each 2 feet in diameter.

(b) A vessel employed in laying or in picking up a telegraph cable shall carry in the same position as the white light mentioned in Article 2 (a), and if a steam vessel, in lieu of that light, three lights in a vertical line one over the other, not less than 6 feet apart. The highest and lowest of these lights shall be red, and the middle light shall be white, and they shall be of such a character as to be visible all round the horizon, at a distance of at least 2 miles. By day she shall carry in a vertical line one over the other, not less than 6 feet apart, where they can best be seen, three shapes not less than 2 feet in diameter, of which the highest and lowest shall be globular in shape and red in colour, and the middle one diamond in shape and white.

(c) The vessels referred to in this Article, when not making way through the water, shall not carry the side-lights, but when making way shall carry them.

(d) The lights and shapes required to be shown by this Article are to be taken by other vessels as signals that the vessel showing them is not under command and cannot therefore get out of the way.

These signals are not signals of vessels in distress and requiring assistance. Such signals are contained in Article 31.

Article 5. A sailing vessel under way, and any vessel being towed, shall carry the same lights as are prescribed by Article 2 for a steam vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

Article 6. Whenever, as in the case of small vessels under way during bad weather, the green and red side-lights cannot be fixed, these lights shall be kept at hand lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than 2 points abaft the beam on their respective sides.

To make the use of these portable lights more certain and easy, the lanterns containing them shall each be painted outside with the colour of the light they respectively contain, and shall be provided with proper screens.

Article 7. Steam vessels of less than 40, and vessels under oars or sails of less than 20, tons gross tonnage, respectively, and rowing boats, when under way, shall not be obliged to carry the lights

mentioned in Article 2 (a) (b) and (c), but if they do not carry them they shall be provided with the following lights :

1. Steam vessels of less than 40 tons shall carry :

(a) In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than 9 feet, a bright white light constructed and fixed as prescribed in Article 2 (a), and of such a character as to be visible at a distance of at least 2 miles.

(b) Green and red side-lights constructed and fixed as prescribed in Article 2 (b) and (c), and of such a character as to be visible at a distance of at least 1 mile, or a combined lantern showing a green light and a red light from right ahead to 2 points abaft the beam on their respective sides. Such lantern shall be carried not less than 3 feet below the white light.

2. Small steamboats, such as are carried by sea-going vessels, may carry the white light at a less height than 9 feet above the gunwale, but it shall be carried above the combined lantern mentioned in subdivision 1 (b).

3. Vessels under oars or sails, of less than 20 tons, shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

4. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light, which shall be temporarily exhibited in sufficient time to prevent collision.

The vessels referred to in this Article shall not be obliged to carry the lights prescribed by Article 4 (a), and Article 11, last paragraph.

Article 8. Pilot vessels, when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all round the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side-lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side, nor the red light on the starboard side.

A pilot-vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the coloured

lights above mentioned, have at hand ready for use a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

Pilot-vessels, when not engaged on their station on pilotage duty, shall carry lights similar to those of other vessels of their tonnage.

A steam pilot-vessel, exclusively employed for the service of Pilots licensed or certified by any Pilotage authority or the Committee of any Pilotage District in the United Kingdom, when engaged on her station on pilotage duty and in British waters and not at anchor shall in addition to the lights required for all pilot-boats carry at a distance of 8 feet below her white masthead light a red light visible all round the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles and also the coloured side-lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in British waters and at anchor she shall carry in addition to the lights required for all pilot-boats the red light above mentioned but not the coloured side-lights.

When not engaged on her station on pilotage duty she shall carry the same lights as other steam vessels.

Article 9. Fishing-vessels and fishing-boats, when under way and when not required by this Article to carry or show the lights hereinafter specified, shall carry or show the lights prescribed for vessels of their tonnage under way.

(a) Open boats, by which is to be understood boats not protected from the entry of sea water by means of a continuous deck, when engaged in any fishing at night with outlying tackle extending not more than 150 feet horizontally from the boat into the seaway, shall carry one all-round white light.

Open boats, when fishing at night, with outlying tackle extending more than 150 feet horizontally from the boat into the seaway, shall carry one all-round white light, and in addition, on approaching or being approached by other vessels, shall show a second white light at least 3 feet below the first light and at a horizontal distance of at least 5 feet away from it in the direction in which the outlying tackle is attached.

(b) Vessels and boats, except open boats as defined in subdivision (a), when fishing with drift-nets, shall, so long as the nets are wholly or partly in the water, carry two white lights where they can best be seen. Such lights shall be placed so that the vertical distance between them shall be not less than

6 feet and not more than 15 feet, and so that the horizontal distance between them, measured in a line with the keel, shall be not less than 5 feet and not more than 10 feet. The lower of these two lights shall be in the direction of the nets, and both of them shall be of such a character as to show all round the horizon, and to be visible at a distance of not less than 3 miles.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than 20 tons gross tonnage shall not be obliged to carry the lower of these two lights; should they, however, not carry it, they shall show in the same position (in the direction of the net or gear) a white light, visible at a distance of not less than one sea mile, on the approach of or to other vessels.

(c) Vessels and boats, except open boats as defined in sub-division (a), when line-fishing with their lines out and attached to or hauling their lines, and when not at anchor or stationary within the meaning of sub-division (h), shall carry the same lights as vessels fishing with drift-nets. When shooting lines, or fishing with towing lines, they shall carry the lights prescribed for a steam or sailing vessel under way respectively.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than 20 tons gross tonnage shall not be obliged to carry the lower of these two lights; should they, however, not carry it, they shall show in the same position (in the direction of the lines) a white light, visible at a distance of not less than one sea mile on the approach of or to other vessels.

(d) Vessels, when engaged in trawling, by which is meant the dragging of an apparatus along the bottom of the sea—

1. If steam vessels, shall carry in the same position as the white light mentioned in Article 2 (a), a tricoloured lantern so constructed and fixed as to show a white light from right ahead to two points on each bow, and a green light and a red light over an arc of the horizon from two points on each bow to two points abaft the beam on the starboard and port sides respectively; and not less than 6 nor more than 12 feet below the tricoloured lantern a white light in a lantern, so constructed as to show a clear uniform and unbroken light all round the horizon.

2. If sailing vessels, shall carry a white light in a lantern, so constructed as to show a clear uniform and unbroken light all round the horizon, and shall also, on the approach

of or to other vessels, show where it can best be seen a white flare-up light or torch in sufficient time to prevent collision.

All lights mentioned in sub-division (d) 1 and 2 shall be visible at a distance of at least 2 miles.

(e) Oyster dredgers and other vessels fishing with dredge-nets shall carry and show the same lights as trawlers.

(f) Fishing vessels and fishing boats may at any time use a flare-up light in addition to the lights which they are by this Article required to carry and show, and they may also use working lights.

(g) Every fishing vessel and every fishing boat under 150 feet in length, when at anchor, shall exhibit a white light visible all round the horizon at a distance of at least 1 mile.

Every fishing vessel of 150 feet in length or upwards, when at anchor, shall exhibit a white light visible all round the horizon at a distance of at least 1 mile, and shall exhibit a second light as provided for vessels of such length by Article 11.

Should any such vessel, whether under 150 feet in length, or of 150 feet in length or upwards, be attached to a net or other fishing gear, she shall on the approach of other vessels show an additional white light at least 3 feet below the anchor light, and at a horizontal distance of at least 5 feet away from it in the direction of the net or gear.

(h) If a vessel or boat when fishing becomes stationary in consequence of her gear getting fast to a rock or other obstruction, she shall in daytime haul down the day-signal required by subdivision (k); at night show the light or lights prescribed for a vessel at anchor; and during fog, mist, falling snow, or heavy rain-storms make the signal prescribed for a vessel at anchor. (See sub-division (d) and the last paragraph of Article 15.)

(i) In fog, mist, falling snow, or heavy rain-storms, drift-net vessels attached to their nets, and vessels when trawling, dredging, or fishing with any kind of drag-net, and vessels line fishing with their lines out, shall, if of 20 tons gross tonnage or upwards, respectively, at intervals of not more than one minute make a blast; if steam vessels, with the whistle or syren, and if sailing vessels with the fog-horn; each blast to be followed by ringing the bell. Fishing vessels and boats of less than 20 tons gross tonnage shall not be obliged to give the above-mentioned signals; but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

(k) All vessels or boats fishing with nets or lines or trawls, when under way, shall in daytime indicate their occupation to an approaching vessel by displaying a basket or other efficient signal where it can best be seen. If vessels or boats at anchor have their gear out, they shall, on the approach of other vessels, show the same signal on the side on which those vessels can pass.

The vessels required by this Article to carry or show the lights hereinbefore specified shall not be obliged to carry the lights prescribed by Article 4 (a), and the last paragraph of Article 11.

Article 10. A vessel which is being overtaken by another shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

The white light required to be shown by this Article may be fixed and carried in a lantern, but in such case the lantern shall be so constructed, fitted, and screened that it shall throw an unbroken light over an arc of the horizon of 12 points of the compass, viz., for 6 points from right aft on each side of the vessel, so as to be visible at a distance of at least 1 mile. Such light shall be carried as nearly as practicable on the same level as the side-lights.

Article 11. A vessel under 150 feet in length, when at anchor, shall carry forward, where it can best be seen, but at a height not exceeding 20 feet above the hull, a white light in a lantern so constructed as to show a clear, uniform, and unbroken light visible all round the horizon at a distance of at least 1 mile.

A vessel of 150 feet or upwards in length, when at anchor, shall carry in the forward part of the vessel, at a height of not less than 20, and not exceeding 40, feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than 15 feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

A vessel aground in or near a fairway shall carry the above light or lights and the two red lights prescribed by Article 4 (a).

Article 12. Every vessel may, if necessary in order to attract attention, in addition to the lights which she is by these Rules required to carry, show a flare-up light or use any detonating signal that cannot be mistaken for a distress signal.

Article 13. Nothing in these Rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the ex-

hibition of recognition signals adopted by shipowners, which have been authorised by their respective Governments and duly registered and published.

Article 14. A steam vessel proceeding under sail only, but having her funnel up, shall carry in daytime, forward, where it can best be seen, one black ball or shape 2 feet in diameter.

SOUND-SIGNALS FOR FOG, ETC.

Article 15. All signals prescribed by this Article for vessels under way shall be given :

1. By "steam vessels" on the whistle or syren.
2. By "sailing vessels and vessels towed" on the fog-horn.

The words "prolonged blast" used in this Article shall mean a blast of from 4 to 6 seconds' duration.

A steam vessel shall be provided with an efficient whistle or syren, sounded by steam or some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient fog-horn, to be sounded by mechanical means and also with an efficient bell.* A sailing vessel of 20 tons gross tonnage or upwards shall be provided with a similar fog-horn and bell.

In fog, mist, falling snow, or heavy rain-storms, whether by day or night, the signals described in this Article shall be used as follows, viz. :

(a) A steam vessel having way upon her, shall sound, at intervals of not more than 2 minutes, a prolonged blast.

(b) A steam vessel under way, but stopped and having no way upon her, shall sound, at intervals of not more than 2 minutes, two prolonged blasts, with an interval of about 1 second between them.

(c) A sailing vessel under way shall sound, at intervals of not more than 1 minute, when on the starboard tack one blast, when on the port tack two blasts in succession, and when with the wind abaft the beam three blasts in succession.

(d) A vessel, when at anchor, shall, at intervals of not more than 1 minute, ring the bell rapidly for about 5 seconds.

(e) A vessel when towing, a vessel employed in laying or in picking up a telegraph cable, and a vessel under way, which is unable to get out of the way of an approaching vessel through

* In all cases where the Rules require a bell to be used a drum may be substituted on board Turkish vessels, or a gong where such articles are used on board small sea-going vessels.

not being under command, or unable to manœuvre as required by these Rules shall, instead of the signals prescribed in subdivisions (a) and (c) of this Article, at intervals of not more than 2 minutes, sound three blasts in succession, viz.: one prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

Sailing-vessels and boats of less than 20 tons gross tonnage shall not be obliged to give the above-mentioned signals, but if they do not, they shall make some other efficient sound-signal at intervals of not more than 1 minute.

SPEED OF SHIPS TO BE MODERATE IN FOG, ETC.

Article 16. Every vessel shall, in a fog, mist, falling snow, or heavy rain-storms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog-signal of a vessel the position of which is not ascertained, shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.*

STEERING AND SAILING RULES.

PRELIMINARY.—RISK OF COLLISION.

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

Article 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, viz.:—

(a) A vessel which is running free shall keep out of the way of a vessel which is close hauled.

(b) A vessel which is close hauled on the port tack shall keep out of the way of a vessel which is close-hauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same

* Automatic fog-horns, whistles and bells should be fitted in all ships. They are a great relief to the officer on watch and record the intervals exactly.

side, the vessel which is to windward shall keep out of the way of the vessel which is to leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

Article 18. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This article only applies to cases where vessels are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two vessels is end on, or nearly end on, to the other ; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own ; and, by night, two cases in which each vessel is in such a position as to see both the side-lights of the other.

It does not apply, by day, to cases in which a vessel sees another ahead crossing her own course ; or by night, to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

Article 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

Article 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam-vessel shall keep out of the way of the sailing vessel.

Article 21. Where by any of these Rules one of two vessels is to keep out of the way, the other shall keep her course and speed.

Note.—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision cannot be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert collision. (*See Articles 27 and 29.*)

Article 22. Every vessel which is directed by these Rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

Article 23. Every steam vessel which is directed by these Rules

to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

Article 24. Notwithstanding anything contained in these Rules, every vessel, overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam, i.e., in such a position, with reference to the vessel which she is overtaking, that at night she would be unable to see either of that vessel's side-lights, shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these Rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel cannot always know with certainty whether she is forward of or abaft this direction from the other vessel, she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

Article 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

Article 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This Rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

Article 27. In obeying and construing these Rules, due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above Rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER.

Article 28. The words "short blast" used in this Article shall mean a blast of about one second's duration.

When vessels are in sight of one another, a steam vessel under way, in taking any course authorised or required by these Rules, shall indicate that course by the following signals on her whistle or syren, viz.:

One short blast to mean, "I am directing my course to star-board."

Two short blasts to mean, "I am directing my course to port."

Three short blasts to mean, "My engines are going full speed astern."

NO VESSEL UNDER ANY CIRCUMSTANCES TO NEGLECT PROPER PRECAUTIONS.

Article 29. Nothing in these Rules shall exonerate any vessel, or the owner, or master, or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper look-out, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

RESERVATION OF RULES FOR HARBOURS AND INLAND NAVIGATION.

Article 30. Nothing in these Rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbour, river, or inland waters.

DISTRESS SIGNALS.

Article 31.—When a vessel is in distress and requires assistance from other vessels or from the shore, the following shall be the signals to be used or displayed by her, either together or separately :

In the daytime—

- (a) A gun or other explosive signal fired at intervals of about a minute.
- (b) International Code signal of distress indicated by N.C.
- (c) The distant signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.
- (d) A continuous sounding with any fog-signal apparatus.

At night—

- (a) A gun or other explosive signal fired at intervals of about a minute.
- (b) Flames on the vessel (a burning tar-barrel, oil-barrel, &c.).
- (c) Rockets or shells, throwing stars of any colour or description, fired one at a time, at short intervals.
- (d) A continuous sounding with any fog-signal apparatus.

AIDS TO MEMORY IN VERSES.

BY THOMAS GRAY, C.B.

I. Two steam vessels meeting—

When all three lights you see ahead
Port your helm and show your *Red*.

II. Two steamships passing—

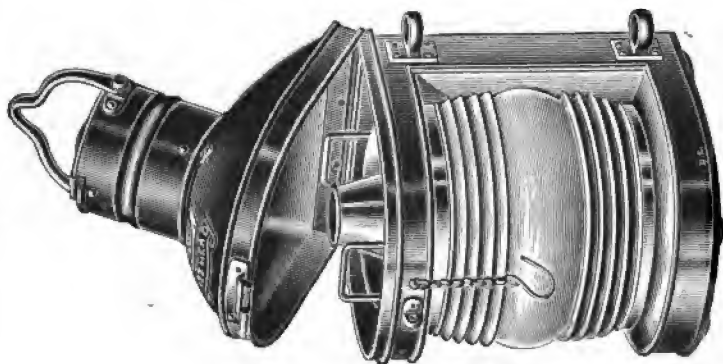
Green to Green—or Red to Red—
Perfect safety—go ahead.

PATENT WIND-PROOF SHIP SIGNAL LAMPS

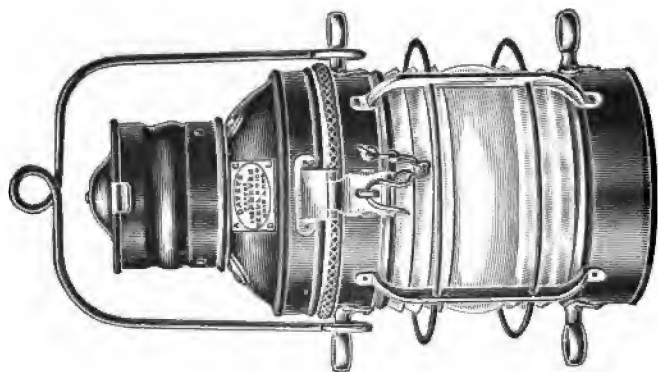
FIG. 42.



SIDE LAMP.



MASTHEAD LAMP.



ANCHOR LAMP.

III. Two steamships crossing—

If to starboard *Red* appear
 'Tis your duty to keep clear ;
 To act as judgment says is proper,
 To *Port*—or *Starboard*—*Back*—or stop her !
 But when upon your port is seen
 A steamer's starboard light of *Green*,
 There's not so much for you to do,
 As *Green* to port keeps clear of you.

This is the position of greatest danger.

IV. All ships must keep a good look-out, and steamers must stop and go astern if necessary.

Both in safety and in doubt
 Always keep a good look-out ;
 In danger, with no room to turn,
Ease her—stop her—go astern.

The officer on watch on sighting a light should try at once to ascertain by change of bearing the direction in which the vessel carrying it is going (if the ship draws aft, you will pass ahead ; if forward, you will pass astern) and should not touch the helm of the vessel he is in charge of until he can do so with confidence. Collisions are generally caused by the vacillating conduct of one of the vessels.

The vessel that holds on by right should stop or go astern in preference to altering her helm.

Vessels should avoid approaching too near squadrons of warships, or attempting to pass ahead of or break through their lines or formations.

In going through narrow channels keep to the right or starboard hand, as in walking.

None of these rules interfere with special extra signals used by different Governments in their warships, and by shipowners as private signals which are authorised,

SHIP'S LIGHTS.

The illustrations (Fig. 42) show the usual form of lights in use. The illuminant is oil (colza or petroleum) or electric light. The officer on watch has to see carefully that they are kept properly burning. Electric lights are generally so arranged that in the event of one giving out another is automatically switched on.

Side-lights, compass-lights, &c., are generally under control from switches in the Chart-room or Wheel-house.

It is always advisable to have spare lights at hand.*

* Illustration of lights kindly lent by Messrs. Hughes, Ltd.

PART VI

MECHANICAL APPLIANCES.

THE principal mechanical appliances with which sailors are concerned are winches (Fig. 43), capstans (Fig. 44), windlasses (Fig. 45)

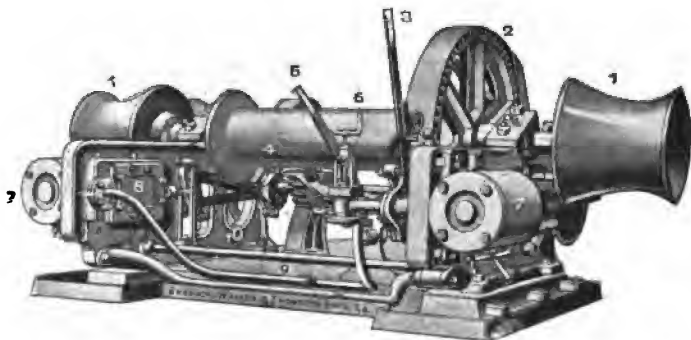


FIG. 43.—STEAM WINCH.

Parts of a winch.

- | | | |
|---------------------|------------------|-----------------|
| 1. Warping end. | 4. Barrel. | 7. Cylinders. |
| 2. Main spur wheel. | 5. Clutch lever. | 8. Steam chest. |
| 3. Reversing lever. | 6. Stop valve. | 9. Bed-plate. |

and steering gear (Fig. 47). The last named being of a somewhat complex nature is, on most ships, in charge of the engineers. These different engines are supplied with steam by means of pipes leading to them from the main boilers, if the ship be under way, or from the donkey engine if she be in port.

In a sailing ship the minor appliances are winches for wire hawsers (Fig. 46), crab winches for working gear such as sheets, halliards, &c.

These appliances are easily worked if, before starting operations, attention is paid to such preparations as warming through, ejection

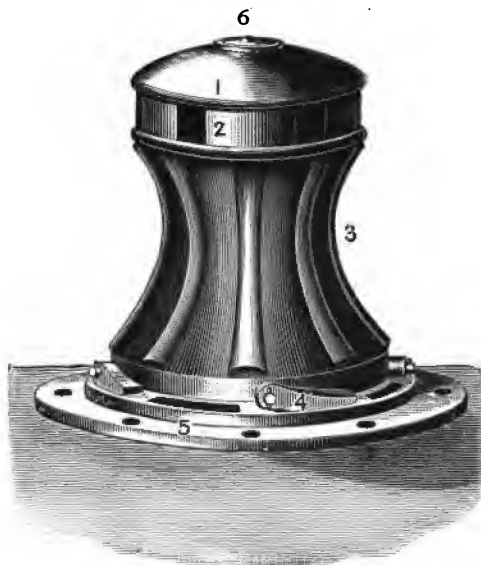


FIG. 44.—CAPSTAN.

Parts of a capstan.

- | | |
|-----------------------|---|
| 1. Drumhead. | 4. Pawls. |
| 2. Capstan bar holes. | 5. Pawl-rim. |
| 3. Barrel. | 6. Top of spindle which secures
the whole to the deck. |

of superfluous water from pipes and cylinders, careful oiling, &c. To insure safety, supervision should be constant during work. If in the open air these appliances should be kept covered when not in use. Electricity or hydraulic power are sometimes used instead of steam.

There are, too, engine-room telegraphs (Fig. 48), helm signalling

apparatus (Fig. 49), telephones, steam whistles, log, sounding apparatus, &c., all under the immediate control of the officer

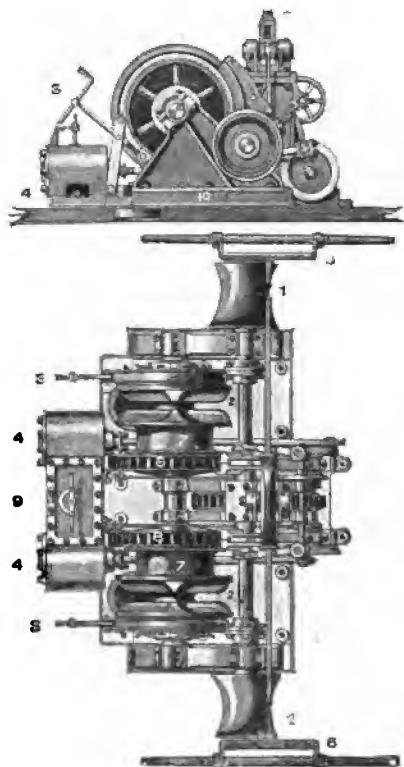


FIG. 45.—STEAM WINDLASS.

- | | | |
|---------------------------------|--|---------------------------------|
| 1. Warping ends. | 4. Cylinders. | 7. Main-piece. |
| 2. Cable holders or
lifters. | 5. Cross-head in which
hand-gear ships. | 8. Main cone driving
wheels. |
| 3. Brakes. | 6. Hand-power levers. | 9. Valve-casings.] |
| | 10. Bed-plate. | |

on watch on the bridge. It is of great importance that a young officer should familiarise himself early with these appliances

Telegraphs for twin screws are fitted with two levers,

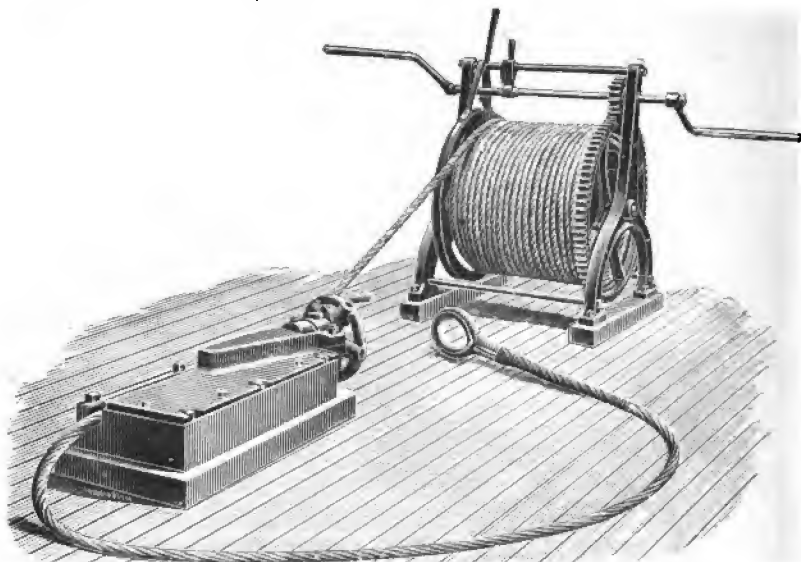


FIG. 46.—BULLIVANTS' PURCHASE REEL AND PATENT NIPPER.



FIG. 47.—BRIDGE—BINNACLE, STEAM STEERING GEAR, AND
ENGINE-ROOM TELEGRAPH.

LIGHTHOUSES AND LIGHT-VESSELS.

Sailors should study the different systems of lights used in Lighthouses and Light-vessels.

Lighthouses are distinguished (for daylight purposes) by colour,



FIG. 49.—HELM SIGNALING APPARATUS.

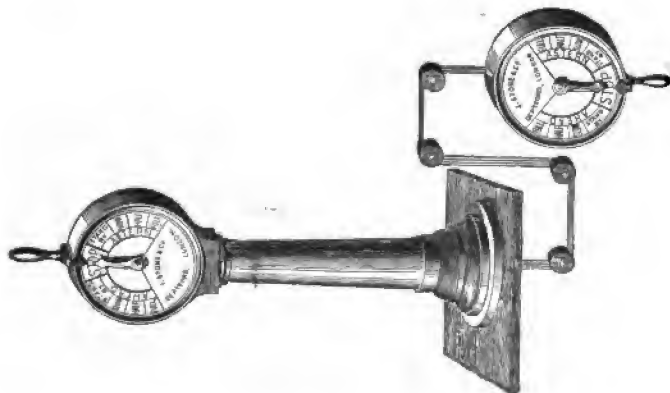


FIG. 48.—ENGINE-ROOM TELEGRAPHS.

stripes, squares, bands, &c. ; at night by the quality and style of their light. They are built of stone or iron, and are sometimes placed on piles. In fogs they are distinguished by sound—gongs, whistles, syrens, explosives, &c.

The lights used in lighthouses and light-vessels are :

1. **Fixed**, a steady burning light.
2. **Revolving**, where by means of mechanism the light is hidden at times, the change from darkness to light, and back again, being comparatively gradual.
3. **Flashing**, showing flashes of light at certain intervals.
4. **Occluding**, in which the light is suddenly extinguished and as suddenly exposed.

At times there are combinations of these systems, and variation is obtained by different time intervals.

The light is obtained by burning oil (paraffin or a vegetable oil),

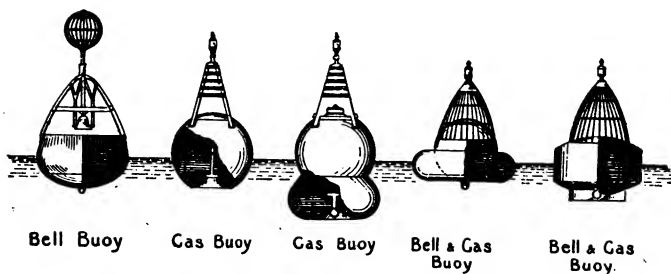
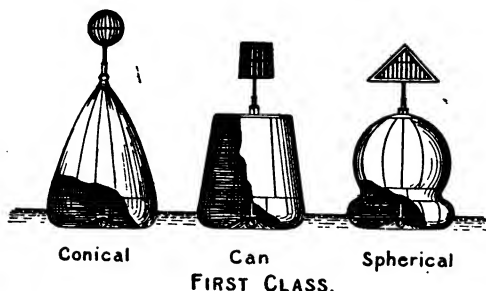


FIG. 50.—BUOYS USED BY THE CORPORATION OF THE TRINITY HOUSE.

gas, or electric light. In the two former cases an elaborate system of wicks or burners is used, and in the latter carbon points.

Great attention is given to the construction of the glass cases which contain the lights and in the system of reflection. The two systems in use are the catoptric or reflector system, and the dioptric or lens system. These two systems are now constantly



**BISHOP ROCK LIGHTHOUSE,
CORNWALL.**



**MAPLIN SCREW-PILE LIGHTHOUSE,
RIVER THAMES.**



**STONENESS PILE LIGHTHOUSE,
RIVER THAMES.**



**PENDEEN LIGHTHOUSE,
CORNWALL.**



**PRINCES CHANNEL LIGHT-VESSEL,
RIVER THAMES.**



**SPURN LIGHT-VESSEL, RIVER
HUMBER, SHOWING LANTERN
HOISTED IN POSITION.**

THE
JOURNAL
OF THE
ROYAL ANTHROPOLOGICAL INSTITUTE

combined in the best lights and are known as the holophotal system, the loss of light in which is exceedingly small.

Buoys mark shoals or edges of shoals and such-like, and are of various kinds and shapes :

1. Bell-buoys have a bell on them which is rung by the motions of the waves.
2. Gas-buoys are illuminated with a gas-jet, the gas being stored in the buoy.
3. Sound-buoys make a noise.
4. Telegraph cables and wrecks are marked by green buoys. The word "Telegraph," or "Wreck," painted in white letters on the buoy, indicates its special purpose.

The different sides of a channel are marked also with different styles of buoys. The system used by the Trinity House places uniform coloured buoys on the starboard side of a channel (that is the right-hand side entering a harbour), and parti-coloured buoys on the port side.

There are also pillar-buoys and spar-buoys.

Beacons are marks placed on shoals and points of land as marking points, and are of various kinds, sometimes a pile of stones, or a wooden or iron pillar, &c.

Light-ships carry a riding-light so that it is possible to tell which way the tide is running when going past them.

SOUND SIGNALS

are notoriously unreliable warnings for vessels to follow when navigating among rocks or shoals. In thick weather, constant attention to soundings is the only safe method. Very powerful syrens are now established in the most foggy localities frequented by ships, but at times, atmospheric conditions render all attempts to propagate sound useless. Over some areas the sound waves seem to jump; in other areas the vessel itself, or its sails or other obstacles may reflect the sound waves. On board sailing ships fog-horns are used, on steamers steam whistles or syrens, vessels at anchor use a bell. (*See Rule of the Road Regulations.*) Sound signals are only aids to navigation in thick weather, not absolute safeguards.

JUDGING DISTANCE BY THE EYE.

A most useful accomplishment, and one to be acquired by exercise and practice. The art of accurately gauging distance by sight is of great value when piloting a vessel into port. It may be roughly calculated, in approaching land where people are standing

about, that at a distance of 500 yards a man's face is not distinguishable at all, at 250 yards features begin to be discernible, and they become quite distinct to ordinary sight at 200 yards. Various tables exist for measuring distances off lighthouses of which the exact height is known, and rules are given for rapid working out of these distances.

HOLDS AND CARGO.

It is generally the duty of a junior officer to see to one or other of the holds under the superintendence of a senior officer. In this matter different companies have different arrangements, but it is important in all cases that the holds be kept thoroughly clean and ready for cargo.

Each hold should be well swept, limber boards lifted, and all limbers carefully cleaned; when there are ballast tanks in the ship fore and aft, the limbers (also called the bilges in these cases) are in the wings of the tanks. Care should be taken after cleaning tanks to see that the manhole doors are properly jointed, and ceiling replaced.

If this is done nothing in the way of refuse can get into them; but they require looking to at every opportunity to ascertain that no cement is broken, and that they are perfectly clean and free from rust and dirt, and that the limber holes are quite free.

When there are no ballast tanks, the limber boards must be carefully replaced and caulked, and if any holes are found in them they must be filled in.

All hold ladders, stanchions, hatch-combings and hatches, pumps, sounding-tubes, and all connected with them should be also overhauled.

In preparing a hold for cargo, it is of course necessary to know the nature of the goods which are to occupy it, as special shifting-boards have to be fitted for some cargoes.

Vessels going out of England generally carry mixed cargoes; some vessels, however, carry special lines of cargo, such as coal, salt, cement, chalk, &c. Each of these cargoes requires some special arrangements.

The cargoes coming into England are generally homogeneous, such as tea, wool, frozen meat, cotton, grain, nitrates, cattle, timber, ores, &c.

Petroleum oil is carried in bulk in steamers specially fitted up for the purpose.

It is neither necessary nor possible in this small volume to lay down rules to meet all cases. A junior officer needs but to know

that these cargoes all require special arrangements; he will be given instructions concerning them in accordance with the usages of his ship. In many cases the laid ceiling takes the place of dun-

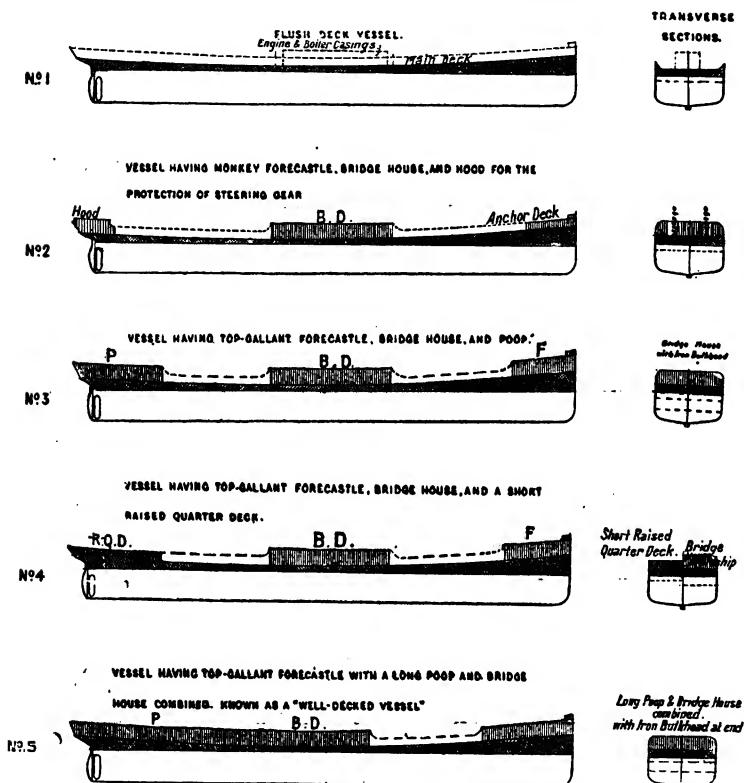
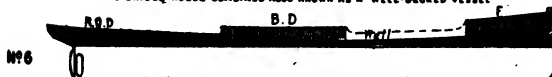


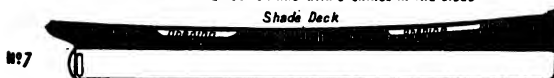
PLATE XXII.—DIFFERENT TYPES OF VESSELS CLASSED IN LLOYD'S REGISTER OF BRITISH AND FOREIGN SHIPPING.

nage, in other cases half an inch to four inches of dunnage should be laid in the ceiling or tops of the ballast tanks athwart ships, so that any water finding its way in will flow to the bilges at the sides of the ballast tanks. Dunnage or mats should always be placed between any fine goods and iron, such as stanchions, &c. Cargo battens are arranged along the side, fore and aft, and several

VESSEL HAVING TOP-BALLAST FORECASTLE WITH A LONG RAISED QUARTER DECK AND BRIDGE HOUSE COMBINED ALSO KNOWN AS A WELL-DECKED VESSEL



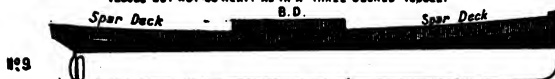
"SHADE DECKED VESSEL" THIS TYPE OF VESSEL HAS A CONTINUOUS UPPER DECK OF LIGHT CONSTRUCTION AND WITH OPENINGS IN THE SIDES



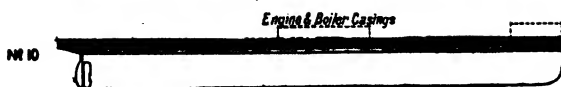
"AWNING DECKED VESSEL" THIS TYPE OF VESSEL HAS A CONTINUOUS UPPER DECK OF LIGHT CONSTRUCTION AND THE SIDES COMPLETELY ENCLOSED ABOVE



"SPAR DECKED VESSEL" THIS TYPE OF VESSEL IS CONSTRUCTED WITH THE SCANTLINGS ABOVE THE MAIN DECK HEAVIER THAN IN AN "AWNING DECKED VESSEL" BUT NOT SO HEAVY AS IN A "THREE DECKED VESSEL".



TURRET DECK VESSEL



TRUNK DECK VESSEL



PLATE XXIII.—DIFFERENT TYPES OF VESSELS CLASSED IN LLOYD'S REGISTER OF BRITISH AND FOREIGN SHIPPING.

inches apart; they prevent contact with the ribs or frames of the vessel.

It must be remembered that iron ships "sweat" a good deal,

and care has to be taken that this moisture does not come into contact with any goods likely to be damaged by it.

Casks of liquid should be stowed fore and aft, bung up and bilge free, the stowage commencing amidships and working towards the sides and the ends.

Each cask should have a bed under each quarter with quoin on either side, on top of the beds, to fix the casks securely and keep the bilge of each cask free.

The next tier is stowed so that the bilge of each cask rests on the space between four cask ends, and so on.

Three heights of pipes or butts, four heights of puncheons, and five heights of hogsheads * can be stowed in a hold.

In stowing a hold, great care and attention should be paid to the matter of separating all explosives and bad smelling things from the rest of the cargo.†

Many things are liable to spontaneous combustion, and these should on no account be placed in the hold, but should be kept on deck ; acids also should be stowed on deck.

For a cargo of frozen meat, the hold is specially prepared by lining it throughout with a non-conducting material which prevents the escape of the cold from the air forced into the hold from the refrigerating engine.

In dealing with the stowage of all heavy cargoes, such as iron and ores, it is necessary to trim up the weight, which, if retained in the bottom of the ship, would cause her to behave very badly in a seaway, and would be a source of danger.

Cattle cargoes are carried in a particular manner, ships being specially fitted for them.

These few remarks will serve to show the importance of some knowledge of stowage of cargo. On the skill and attention devoted to this matter may depend not only the comfort but the actual safety of all on board. A badly stowed cargo may easily jeopardise a ship and the lives in her, either through its shifting or from some other cause.

It is one of an officer's most important duties to make certain that all goods are placed in the proper position in the holds ; and that they are dunnaged and firmly secured against any possibility of damage or shifting. He should personally satisfy himself on these points.

* A pipe or butt contains	126	gallons	(pi.).
A puncheon	84	„	(pun.).
A hogshead	63	„	(hhd.).

† Felt, straw, oilskins, and such-like, likely to be damaged by sea water, are sometimes stowed in the squares of the hatches.

TALLYING CARGO.

It is frequently necessary for the officer to "tally" (tallying is the act of checking, or taking an account of the goods put into or taken out of the ship), and as he may be called upon to pay part of any loss sustained through non-delivery or damage, it is very necessary that he should be particularly careful in the discharge of this duty. In order to "tally" properly, he must put down in his tallying-book the marks and numbers of every package, and sometimes, in the case of light goods, their measurements; he should take particular note of the state of the packages; if any are found stained, broken, or damaged in any way, he should record the fact, and refuse to sign a clean receipt.

PAINTING, CHIPPING, AND SCRAPING.

These occupations absorb a good deal of time on board modern vessels. The result is a smart, trim ship, and probably a much longer lived one than would be the case were they neglected. Could air and moisture be excluded from iron and steel work, rust would not occur, but as immunity is impossible, it only remains to minimise the evil as far as possible. Ballast tanks and holds require particular attention. When a plate has been well scraped and chipped, a good plan is to give it an all-over thin coating of warm raw oil, which, when dry, is painted over. Ready-mixed paints are now procurable, and are much to be preferred to the ordinary kinds mixed on board ship. Some paints give off a gas which becomes explosive when mixed with air. Great care, therefore, must be taken to store broached paints in a cool place. The secret of successful painting is to cover the surface evenly with a thin coat of paint, to allow this to dry, and repeat the process if necessary.

When painting over a hatchway or gangway, up or along which persons may come, be sure to hang a rag down over the plank you are working on as a warning signal.

USING A GANTLINE.

When using a gantline to raise or lower a man from aloft or over the ship's side, remember that the raising or lowering power must be equivalent to the man's weight. This applies specially when a man lowers himself. Failure to properly maintain the balance has often resulted in serious or fatal accident.

HATCHES.

In placing hatches on care must be taken that the *fore and afters* are in their proper places and that the tarpaulins are placed over smoothly and neatly. and secured at the sides by the cleats, battens and wedges.

FIRE.

Fire stations are established in all ships and fire drill is gone through at certain times. It is well known that the judicious use of an extinguishing appliance will often check a fire at the early stage; but once it has obtained a good hold on a vessel very little can be done to save her.

Non-safety matches, smoking in cabins and holds (particularly the latter) should be strictly prohibited, and every one should co-operate to prevent any chance of a conflagration.

Fire extinguishers are usually well distributed about a ship. Some cargoes—such as oil, coal, nitrate of soda, &c.—are more liable to take fire than others and special care has to be used in dealing with them.

A Fire and Boat Station Bill is always conspicuously posted up in a ship.

PART VII

MISCELLANEOUS.

THE SEA LIFE.

It may not be out of place here to sketch briefly the general outlines of a young mercantile officer's career. First, then, comes the apprentice or midshipman stage, on board a sea-going ship.* When at all possible, it is of the greatest importance, nowadays, that this first stage in an officer's career be preceded by a course of training on board a ship devoted to that purpose.† A solid, all-round education is imparted in these Institutes, as well as a thorough grounding in navigational and seamanship work; and, a matter of almost more importance, boys are subjected to strict discipline and are trained in habits of prompt obedience. A two years' course on the *Worcester* or *Conway* is regarded by the Board of Trade as equivalent to one year's training at sea; so that a student from either ship may present himself for examination for his second mate's certificate after completing three years' sea service instead of having to serve four years, as would otherwise be required.

Seventeen, to seventeen and a half, is the most suitable age at which to go to sea; it allows time, too, for the future sailor to receive a good general education, which is as necessary a preparation for a sailor's profession as for any other.

On the completion of four years' or three years' sea service, as the case may be, the apprentice, or midshipman, may present himself at the proper quarters—at any one of our principal sea-port towns—for examination for a second mate's certificate. The candidate will be expected to answer satisfactorily in the following subjects:

- a. The International Code of Signals.
- b. The construction, use and principle of the barometer, thermometer and hydrometer.
- c. Weights and measures.
- d. First aid to the injured. Also:

* The difference between an apprentice and a midshipman is that the former signs indentures, and is expected to serve the full time or to forfeit the premium paid; the latter may terminate his engagement at the end of a voyage.

† The *Worcester*, off Greenhithe, or the *Conway*, off Rock Ferry.

In the case of an Ordinary Certificate.

- e. The standing and running rigging of ships.
- f. Bending, unbending, setting, reefing, taking in and furling sail.
- g. Sending masts and yards up and down, &c.
- h. Management of a ship when under canvas.
- i. Management of ship's boats in heavy weather.
- j. Dunnaging and stowing cargo, &c.
- k. The rule of the road as regards both steamers and sailing vessels, their regulation lights and fog and sound signals.
- l. The signals of distress, and the signals to be made by ships wanting a pilot, and the liabilities and penalties incurred by the misuse of these signals.
- m. The marking and use of the lead and log lines.
- n. The use and management of the rocket apparatus in the event of a vessel being stranded.
- o. Any questions of a like nature appertaining to the duties of a second mate that the Examiner may think necessary to ask.
- p. Also questions on the additional subjects which are specified in the rules of examination for second mates' certificates of competency for foreign-going ships.

For a Steamship Certificate only.

- e. The standing and running rigging of steamships.
- f. Bending, unbending, setting, reefing, taking in, and furling sail.
- g. Sending masts and yards up and down, &c.
- h. Seeing everything in readiness and clear for getting under way, and the precautions to be then observed with regard to engines, propeller, &c.
- i. Management of a steamship when under canvas.
- j. Management of a ship's boat in heavy weather.
- k. Dunnaging and stowing cargo, &c.
- l. The rule of the road as regards both steamers and sailing vessels, their regulation lights, and fog and sound signals.
- m. Signals of distress, and signals to be made by ships wanting a pilot, and the liabilities and penalties incurred by the misuse of these signals.
- n. The marking and use of the lead and log lines.
- o. The construction, use, and action of the sluices and of the water-ballast tanks.
- p. Engine-room telegraph, &c.
- q. Use and management of the rocket apparatus in the event of a vessel being stranded.
- r. Any other questions of a like nature appertaining to the duties of the second mate of a steamship, which the examiner may think necessary to ask.

The ordinary certificate is available for any class of vessel, the steamship certificates are for steamers only. Full particulars regarding these examinations can be obtained from any mercantile marine shipping office, and from the published regulations issued by the Board of Trade.*

Candidates admitted to examination for second mate's certificate can pass the colour test for eyesight at the same time and place.

A further term of sea service is required in order to qualify for first mate's certificate. Then follow master's and extra-master's certificates.

The rates of pay in the mercantile marine vary considerably. A given scale would probably be misleading. It is too difficult to say much that is definite with regard to the standard of food which is different in, practically, every ship; but, as a rule, food is better in steamers than in sailing vessels.

A few hints may be useful as to the outfit of an apprentice. The length of the voyage he is starting on and the trade in which the ship is engaged must be considered. For a sailing ship voyage to Australia and round the world, the following may be a guide:

- 2 uniform suits, 3 caps, 2 badges.
- 1 strong sea chest and 1 kit bag.
- 1 pilot jacket, 1 straw hat.
- 1 suit oilskins, 1 sou'-wester, 1 pair sea-boots.
- 4 flannel shirts with collars, 3 white shirts, 3 oxford shirts.
- 12 collars, 3 pairs of boots, 1 pair of slippers.
- 1 thick pair of working trousers.
- 1 thin pair of working trousers.
- 4 pairs of dungaree or duck trousers.
- 2 pairs of best dungaree or duck trousers.
- 2 blue jumpers.
- 2 warm under vests, 2 thin under vests.
- 2 pairs thick drawers, 2 pairs thin drawers.
- 3 pairs thick socks, 3 pairs thin socks.
- 1 pair sea-boot stockings.
- 1 pair warm gloves, 1 pair mits, 1 comforter.
- 6 towels, toilet gear.
- 3 pyjama suits, 6 white handkerchiefs, 6 coloured handkerchiefs.
- 1 cardigan jacket.
- Black ties.
- Bed, pillow and blankets, &c., 1 coloured rug.
- Knife, fork, and spoon.
- Enamelled basin.
- 2 enamelled mugs, 1 hookpot, 1 clasp knife.
- 1 housewife.

A smaller outfit suffices for a steamship voyage, which would be shorter, and in many steamers all bedding is provided.

* For full particulars of these examinations, see Board of Trade publications, obtainable through any bookseller.

Besides the above list of necessities, the comfort of a voyage may be considerably increased by having at hand some tins of cocoa and milk, and such-like portable delicacies, which are not to be procured at sea.

The following list of books may be recommended :

Raper's Navigation.
 Griffin's Nautical Series.
 Proctor's Small Star Atlas.
 Whitaker's Almanac.
 Dictionary.
 Low's Pocket Encyclopædia.
 Pocket Atlas.
 Bible with Maps.
 Darwin's Voyage of a Naturalist.
 Beauties of Nature. Lubbock.
 Elements of Science. Mivart.

A pair of binoculars or a small telescope are the only instruments likely to be required on a first voyage. On the second or third voyage a sextant may be taken with profit. The apprentice should lose no opportunity of becoming thoroughly familiar with the compass on board his ship.

After obtaining his second mate's certificate, the young officer may elect to remain in his present service, or he may try for an appointment in the Indian Marine, the Hooghly Pilot Service, &c. If he has been appointed to the Royal Naval Reserve, he may now put in the twelve months' service allowed in the Royal Navy, a proceeding likely to be of great service to him in the later pursuit of his profession.

The following are a few of the many firms that carry apprentices or midshipmen, the terms for which can be obtained directly from them :

FIRM.	ADDRESS.	CLASS.
Anglo-American Oil Co. {	22 Billiter Street, London, E.C.	} Sail.
Asiatic Steam Navigation Co. }	6 Dale Street, Liverpool	} Steam.
D. Bruce & Co. }	10 and 11 Lime Street, Liverpool	} Sail.
The British India Steam Navigation Co. }	23 Great Winchester Street, London.	} Steam.
Cayzer, Irvine & Co., "Clan Line" }	115 Leadenhall Street, London, E.C.	} Steam.

FIRM.	ADDRESS.	CLASS.
J. Corry & Co.	9 and 11 Fenchurch Street, London, E.C.	Steam.
T. Dixon & Sons, " Lord Line "	113 Corporation Street, Bel- fast	Steam.
P. Denniston & Co.	103 Bath Street, Glasgow . .	Sail.
Devitt & Moore	39 Fenchurch Street, London, E.C.	Sail train- ing ship.
Elder, Dempster & Co.	African House, Water Street, Liverpool	Steam.
Fernie & Co.	7 Rumford Street, Liverpool	Sail.
Federal Steam Naviga- tion Co.	2 Fenchurch Avenue, Lon- don, E.C.	Steam.
Galbraith, Hill & Co.	Billiter Square Buildings, London, E.C.	Sail.
Guthrie & Co., " Village Line "	62 Leadenhall Street, Lon- don, E.C.	Sail.
Gracie, Beazley & Co.	14 Water Street, Liverpool .	Sail.
Houlder Bros.	147 Leadenhall Street, Lon- don, E.C.	Steam.
C. Heyn & Sons, " Head Line "	Belfast	Steam.
Ismay, Imrie & Co.	30 James Street, Liverpool .	Sail train- ing ship.
J. Joyce & Co.	Tower Chambers, Liverpool.	Sail.
P. Iredale & Porter	Mersey Chambers, Liverpool	Sail.
G. Jamieson	28 South Castle Street, Liver- pool	Sail and Steam.
Jenkins & Co., " Shire Line "	23 Leadenhall Street, Lon- don, E.C.	Steam.
W. Lund, " Blue Anchor Line "	3 East India Avenue, Lon- don, E.C.	Steam.
Montgomery & Co.	63 Mark Lane, London, E.C.	Sail.
G. Milne & Co.	Aberdeen	Sail.
Neptune Steam Naviga- tion Co., Ltd.	Sunderland	Steam.
New Zealand Shipping Co., Ltd.	138 Leadenhall Street, Lon- don, E.C.	Steam.
J. Nourse	3 Fenchurch Avenue, Lon- don, E.C.	Sail.
B. T. Royden	The Atlantic, Brunswick Street, Liverpool	Steam.
G. Smith & Sons, " City Line "	75 Bothwell Street, Glasgow	Steam.
G. M. Steeves & Co.	27 Leadenhall Street, Lon- don, E.C.	Sail and Steam.
Trinder, Anderson & Co. Thompson, Anderson & Co.	4 St. Mary Axe, London, E.C. Fenwick Chambers, Liver- pool	Sail. Sail.

FIRM.	ADDRESS.	CLASS.
R. Thomas & Co.	26 Chapel Street, Liverpool .	Sail.
Turner & Co. (Asiatic S. N. Co.)	6 Dale Street, Liverpool .	Steam.
C. E. de Wolf & Co.	28 Brunswick Street, Liverpool .	Sail.
Watson Bros.	134 St. Vincent Street, Glasgow .	Sail.
A. Weir & Co.	102 Hope Street, Glasgow .	Sail.

THE DUTIES OF JUNIOR OFFICERS.

The general duties of junior officers (*i.e.*, all under the grade of second officer) are, on board steamships, to keep watch and work holds in co-operation with one of the senior officers ; to look after the mails, signals, rockets, baggage ; attend to the telegraphs ; tally cargo ; do a certain amount of clerical work in connection with cargoes and logs ; work up dead reckonings ; take compass errors ; work various other problems in navigation, and relieve the senior officers at meal times, &c. The general work varies in different companies.

NOTES ON POINTS OF ETIQUETTE : KEEPING AND RELIEVING WATCH, ETC.

To some persons attention to the smaller points of etiquette may appear a trivial matter ; but it is a wonderful strengthener of discipline, and ought not to be neglected on board ship. The fact is too often lost sight of, that an officer who has to work hard does not on that account lose dignity, and his natural power of command, unless he wills it so. Work properly done adds to, instead of diminishing, a man's dignity and position. On joining a ship a man should at once report himself to the officer in charge.

On going aboard a ship at any time, the good old custom of saluting the quarter-deck * should be carried out. In all mail steamers, and in many other vessels, a quartermaster is at the gangway to receive visitors, and he will return the salute. The customary salute of the Service now is to bring up the hand, with the thumb and fingers straight and close together, to the cap smartly and naturally, the thumb being in line with the outer edge of the

* This custom is supposed to date from the time of Queen Elizabeth, when a crucifix was hung near the stern, all saluting it when passing.

right eyebrow, and the palm of the hand inclined to the left. Officers should always salute when addressing the captain, who will return the salute. On taking charge of a watch, the young officer receives the Course and any of the necessary particulars from the officer he relieves. He should at once realise the full responsibility of his position and remember that the consequences of an error of judgment or inattention on his part may cause the loss of the ship and the lives of all on board. He must keep all his wits about him and not go wool-gathering. He should train himself to see everything and make certain that nothing can escape his vigilance.

Officers when relieving one another should salute ; and the officer being relieved should satisfy himself that his relief understands the course, and that at night time he signs the night order-book. Watches should be relieved promptly. ■■

The night order-book is taken to the captain at or about 8 P.M. ; at the same time the boats, fire-hoses, &c., should be reported "all clear and ready for immediate use." The captain will write up the night orders and return the book to the officer of the watch.

It must be remembered that in a steamer, the Deck Department is responsible for the discipline of the ship, and it should ever be the desire of that department to work amicably with the Engine-room Department. Splashing water into the engine-room, besides being very dangerous, is as annoying to those working below as the upsetting of ashes, the spilling of oil, and dirty boots are to those in charge of the cleanliness on deck. Complaints of these kinds may easily be avoided by a little consideration on both sides, and a decided wish to work in the interests of the ship. Any request for steam on the winches, or windlass, or for water for washing decks, should be sent to the engineer on watch, and, when finished with, a message should also be sent down to him. When going into anchor, notice should always be sent to the engineer, at least half an hour beforehand.

The quartermaster, or whoever strikes the bells at night time, should see that the lights are burning brightly, and the look-out man on the fore-castle should sing out "All's well," or give some signal to show he is on the *qui vive*.

On no account should a master permit the officer on watch, or look-out man, to leave the bridge, in a steamer, unless relieved.

In most modern ships, the officer on watch can communicate with the captain, by telephone or speaking-tube, without leaving the bridge or poop. An officer on relieving should ascertain what the weather has been and the movement of the barometer (which

should be hung in the chart-house on the bridge) and should note it during his watch. When near land, the chart, which in many vessels is in a case on the bridge, should be continually consulted.

The officer on watch should on no account ever pass a point of land, island, rock, or light without determining the distance he will pass off, before he gets abreast; and the distance he actually passes off, when abreast.

In a sailing vessel it is often necessary to move about the deck, to see the sails trimmed properly.

The officer of the watch should frequently look at his compass; and if the compass used to steer by is not the standard compass, it should be frequently compared with the latter.

The spare set of lights should be ready.

The officer on watch should above all be vigilant and alert, and ready for immediate action.

If doubtful that things are as they should be, he must not hesitate to call the captain.

When uniform is worn, officers should be carefully exact in matters of detail. Black ties only are admissible, and these unadorned by either pin or ring. As nothing looks worse or is more apparent than slovenliness, or irregularities in the wearing of uniform, officers should study to be irreproachable in dress.

The young officer should make it his business to know what duties will be required of him on promotion. He should be always fit and ready for promotion and competent to undertake the extra duties it brings.

MAXIMS.

- I. See all clear before dark.
- II. A place for everything and everything in its place.
- III. He who strives the tempest to disarm
Should never first embroil the lee yard-arm.
- IV. With the rain before the wind,
Your tops'ls halliards you must mind.
But with the wind before the rain,
Your tops'l you can hoist again.
- V. If clouds are gathering thick and fast
Look out sharp for sail and mast;
But, if they lag upon the road,
Keep your flying kites abroad.
- VI. The evening red and the morning grey,
Are sure signs of a fine day;
But, the evening grey and morning red
Make the sailor shake his head.

- VII. See everything as you pass it.
 VIII. The four L's,
 Lead, Log, Latitude, Look-out.

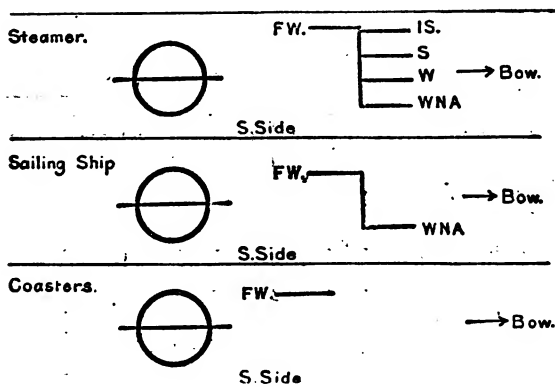


FIG. 51.—LOAD-LINE MARKS.

On the port side the marks point the same way.

FW = Fresh Water.

W = Winter.

IS = Indian Summer.

WNA = Winter N. Atlantic.

S = Summer.

The disc is 12 inches in diameter, and punched in ship's side.

The upper edge of the lines indicate the depth to which the ship can be loaded in salt water, and at the different seasons, as indicated by the letters.

The disc is placed on the ship's side, amidships, and according to the rules laid down under the Merchant Shipping (Load-Line) Act.

The ship's name must be clearly painted, on the bow and on the stern, in letters not less than four inches high. The name of the port of registry must also be painted on the stern. Every ship has also an official number.

SOUNDING TABLE.

The following table is very useful for correcting flying soundings, and is used in the following manner. Suppose the vessel is going 6 knots and a sounding is taken; the dial registers 90 fathoms. Refer to the table with 90 fathoms in the left-hand column, and under 6 knots will be found a correction— $26\frac{1}{2}$ to be applied; this gives a true depth of $63\frac{1}{2}$ fathoms, a result quite close enough for practical purposes.

* Correction to be applied to the apparent sounding to obtain the true depth.*

Knot = 6086.7 feet. Lead (30 lbs.) descends 100 fathoms in 60 seconds.

Depths in fathoms as registered on Machine.	SPEED OF SHIP		
	4 knots or 6.7 feet per second.	6 knots or 10.1 feet per second.	8 knots or 13.5 feet per second.
	fathoms	fathoms	fathoms
170	—	—	-69
160	—	—	-65
150	—	-44	-61
140	—	-41	-57
130	-22½	-38	-53
120	-21	-35	-48½
110	-18¾	-32½	-44½
100	-17	-29½	-40½
90	-15½	-26½	-36½
80	-13¾	-23½	-32½
70	-12	-20½	-28½
60	-10½	-17½	-24½
50	-8½	-14½	-20½
40	-6¾	-11¾	-16½
30	-5	-8¾	-12½
20	-3½	-6	-8
10	-1¾	-3	-4
5	-1	-1½	-2

USEFUL INFORMATION IN BRIEF.

A cubic foot of fresh water weighs.	.	.	62.39 lbs.
A cubic foot of sea water weighs ..	.	.	64.05 „
A gallon of fresh water weighs .	.	.	10 „
A gallon of sea water weighs. .	.	.	10.276 „
A ton of sea water . . . .	.	.	= 35 cubic feet.
A ton of fresh water . . . .	.	.	= 35.84 „
Ton of displacement of a ship . .	.	.	= 35 „

* "Sounding in Shallow Water." Paper read before the Shipmasters' Society, London, on February 27, 1891. In tidal waters corrections should, of course, be made for state of tide.

Bunker space, allowing for bad trimming	=48 cubic feet per ton.
Circumference of circle	=diameter $\times 3.1416$.
Area of a circle	=diameter ² $\frac{3.1416}{4}$.
Volume of a cylinder	=area of base \times height.
Volume of a sphere	=diameter ³ $\frac{3.1416}{6}$.
Surface of a sphere	=diameter ² $\times 3.1416$.

Light travels 186,000 miles per second.

Sound travels 1120 feet per second.

Nautical mile, sometimes called a knot=6086.70 feet, or 1.151 statute miles.

A cable= $\frac{1}{16}$ of knot=approximately 100 fathoms, or 200 yards.

DISPLACEMENT TABLE FOR DRAUGHT IN FRESH AND SALT WATER.*

Immersion in Salt and Fresh Water.—To find the difference of immersion or draught in salt and fresh water. If from salt to fresh, multiply the draught of salt water by 36, and divide the product by 35. If from fresh to salt, multiply the draught of fresh water by 35 and divide the product by 36.

Example:—Required the draught of a vessel in fresh water when drawing 20 ft. in salt water: $20 \text{ ft.} \times 36 = 720 \div 35 \text{ ft.} = 20 \text{ } 5\frac{1}{2} \text{ in.}$

Table of draughts worked out by the above formula:—

FRESH TO SALT.		SALT TO FRESH.	
Water Mark in Fresh.	Would Draw in Salt.	Water Mark in Salt.	Would Draw in Fresh.
Ft.	Ft. In.	Ft.	Ft. In.
24	23 4	24	24 8 $\frac{1}{2}$
22	21 4 $\frac{1}{2}$	22	22 7 $\frac{1}{2}$
20	19 5 $\frac{1}{2}$	20	20 6 $\frac{1}{2}$
18	17 6	18	18 6 $\frac{1}{2}$
16	15 6 $\frac{1}{2}$	16	16 5 $\frac{1}{2}$
14	13 7 $\frac{1}{2}$	14	14 4 $\frac{1}{2}$
12	11 8	12	12 4 $\frac{1}{2}$
10	9 8 $\frac{1}{2}$	10	10 3 $\frac{1}{2}$
8	7 9 $\frac{1}{2}$	8	8 2 $\frac{1}{2}$
6	5 10	6	6 2 $\frac{1}{2}$

* I am indebted to the valuable publication "The Shipping World Year Book" for this useful table.

TABLES.
MEASURES OF LENGTH.

Inches.	Hands.	Feet.	Yards.	Fthms.	Chains.	Fms.	Mile.
1	...	...	...	...	...	...	...
4	1	...	...	...	...	...	...
12	3	1	...	...	...	...	...
36	9	3	1	...	...	...	...
72	18	6	2	1	...	...	...
792	198	66	22	11	1	...	...
7920	1980	660	220	110	10	1	...
63,360	15,840	5280	1760	880	80	8	1

MEASURES OF WEIGHT.

AVOIRDUPOIS.

	Grains.	Lb. avoirdupois.
Dram	27.34	0.0039
Ounce (16 drams)	437.5	0.0625
Pound (16 ounces)	7000	1
	Ton.	
Stone	0.006	14
Quarter (2 stone)	0.012	28
Cental . . . . .	...	100
Hundredweight (8 stone)	0.05	112
Ton (20 cwt.)	1	2240

TROY AND APOTHECARIES.

	Grains.	Lb. avoirdupois.
Grain	1	
Scruple (Apoth.)	20	0.00285714
Pennyweight (Troy)	24	0.003428571
Drachm (Apoth.) = 3 scruples	60	0.00857143
Ounce (20 dwt. or 8 drachms)	480	0.0685714
Pound (12 ounces)	5760	0.8228571

MEASURES OF AREA.

Square Inch.	Square Feet.	Square Yards.	Square Mile.
1	...	...	...
144	1	...	...
1296	9	1	...
...	27,068,400	3,007,600	1

TIMBER MEASURE.

A shipping ton (timber)	42 cubic feet.
A shipping ton (merchandise)	40 "

COAL.

112 lbs.	= 1 cwt.
2 cwt.	= 1 sack.
10 sacks	= 1 ton.
21 tons 4 cwt.	= 1 brg. or keel.
20 keels, or 424 tons	= 1 ship load.
140 cwt. or 7 tons	= 1 room.

Coal furnishes 60 to 70 per cent. of coke by weight.

MEASURES OF COKE.

4 bushels	= 1 sack.
12 sacks	= 1 chaldron.
21 chaldrons	= 1 score.

BEER MEASURE.

9 gallons	= 1 firkin.
18 gallons	= 1 kilderkin.
36 gallons	= 1 barrel.
54 gallons	= 1 hogshead.
72 gallons	= 1 puncheon.
108 gallons	= 1 butt.

WINE MEASURE.

42 gallons	= 1 tierce.
63 gallons	= 1 hogshead.
84 gallons	= 1 puncheon.
126 gallons	= 1 pipe.
252 gallons	= 1 ton.
22 gallons	= 1 hectolitre.

MEASURES OF CAPACITY.

	Gallons.	Solid Measure. Nearly. Cubic Inches.	Litres.
Gill	0.0312	8.660	0.141
Pint = 4 gills	0.125	34.640	0.567
Quart 2 pints	0.25	69.280	1.135
Pottle 2 quarts	0.5	138.5615	2.270
Gallon 2 pottles	1.0	277.123	4.541
		Cubic Feet.	
Peck	2	0.3207	9.082
Bushel 4 pecks	8	1.2829	36.328
Quarter 8 bushels	64	10.2638	290.625

A tun of ale = 2 butts = 4 hogsheads = 216 gallons = 980.86 litres. A ton of sea water = 35 cubic feet = 218½ gallons nearly = 991.04 litres.

FRENCH MEASURES OF LENGTH.

	In English Inches.	In English Feet = 12 inches.	In English Yards = 3 feet.	In English Fathoms = 6 feet.
Millimètre	0.03937	0.003281	0.0010936	0.0005468
Centimètre	0.39371	0.032809	0.0109363	0.0054682
Décimètre	3.93708	0.328090	0.093633	0.0546816
Mètre	39.37079	3.280899	1.0936331	0.5468165
Décamètre	393.70790	32.808992	10.9363306	5.4681653
Hectomètre	3937.07900	328.089917	109.3633056	54.6816528
Kilomètre	39370.79000	3280.899167	1093.6330556	546.8165278
Myriamètre	393707.90000	32808.991667	10936.3305556	5468.1652778
1 inch = 2.539954 centimètre. 1 foot = 3.0479449 décimètre. 1 yard = 0.9143835 mètre. 1 mile = 1.6093449 kilomètre.				

FRENCH MEASURES OF SURFACE.

	In English Square Feet.	In English Sq. Yards = 9 square Feet.
Centiare or square mètre	10.764299	1.196033
Are or 100 square mètres	1076.429934	119.603326
Hectare or 100 ares	10764.299349	1196.033262
1 sq. inch = 6.4513669 sq. centimètres 1 acre = 0.40467102 hectare. 1 sq. foot = 9.2899683 sq. décimètres. 1 sq. kilomètre = 0.3861161 sq. mile. 1 sq. yard = 0.83609715 sq. mètre or centiare. 1 sq. mile = 2.589945 sq. kilomètre.		

To convert inches into millimètres multiply by 25.4.
To convert yards into mètres divide by 1.094.

FRENCH MEASURES OF CAPACITY.

	In Cubic Inches.	In Cubic Feet = 1728 cubic inches.	In Pints = 34.65923 cubic inches.	In Gallons = 8 pints = 277.27384 cubic inches.	Bushel = 8 galls. = 2218.19075 cubic inches.
Millilitre, or cubic centimètre	0.06103	0.000035	0.00176	0.0002201	0.0000275
Centilitre, or 10 cubic centimètres . .	0.61027	0.000353	0.01761	0.0022010	0.0002751
Déclilitre, or 100 cubic centimètres .	6.10271	0.003532	0.17608	0.0220097	0.0027512
Litre, or cubic décimètre	61.02705	0.035317	1.76077	0.2200967	0.0275121
Décalitre, or centistère	610.27052	0.353166	17.60773	2.2009668	0.2751208
Hectolitre, or décastère	6102.70515	3.531658	176.07734	22.0096677	2.7512085
Kilolitre, or Stère, or cub. mètre . .	61027.05152	35.316581	1760.77344	220.0966767	27.5120846
Myrialitre, or décastère	610270.51519	353.165807	17607.73437	2200.9667675	275.1208459
1 cubic inch = 16.386176 cubic centimètres. 1 cubic foot = 28.315312 cubic décimètres. 1 gallon = 4.543458 litres.					

FRENCH MEASURES OF WEIGHT.

	In English Grains.	In Troy Oz. = 480 grains.	Avoir. Lbs. = 7000 grains.	Cwt. = 112 lbs. = 784000 grains.	Ton = 20 cwt. = 15680000 grains.
Milligramme	0.01543	0.000032	0.0000022	0.0000000	0.0000000
Centigramme	0.15432	0.000322	0.0000220	0.0000002	0.0000000
Décligramme	1.54323	0.003215	0.0002205	0.0000020	0.0000001
Gramme	15.43235	0.032151	0.0022046	0.0000197	0.0000010
Décamgramme	154.32349	0.321507	0.0220462	0.0001968	0.0000098
Hectogramme	1543.23488	3.215073	0.2204621	0.0019684	0.000084
Kilogramme	15432.34880	32.150727	2.2046213	0.0196841	0.000842
Myriagramme	154323.48800	321.507267	22.0462126	0.1968412	0.008421
1 grain = 0.064799 gramme. 1 troy oz. = 31.103496 grammes. 1 lb. avoirdupois = 0.453593 kilogramme. 1 cwt. = 50.802377 kilogrammes.					

TABLE FOR CONVERTING KNOTS INTO MILES.

The Admiralty Knot = 6080* feet. Statute Mile = 5280 feet.

Knots.	Miles.	Knots.	Miles.	Knots.	Miles.	Knots.	Miles.	Knots.	Miles.	Knots.	Miles.	Knots.	Miles.
1.00	1.151	4.25	4.893	7.50	8.636	10.75	12.378	14.00	16.121	17.25	19.863	20.50	23.606
1.25	1.439	4.50	5.181	7.75	8.924	11.00	12.666	14.25	16.409	17.50	20.151	20.75	23.893
1.50	1.729	4.75	5.469	8.00	9.212	11.25	12.954	14.50	16.696	17.75	20.439	21.00	24.181
1.75	2.015	5.00	5.757	8.25	9.300	11.50	13.242	14.75	16.984	18.00	20.727	21.25	24.468
2.00	2.303	5.25	6.045	8.50	9.787	11.75	13.530	15.00	17.272	18.25	21.015	21.50	24.757
2.25	2.590	5.50	6.333	8.75	10.075	12.00	13.818	15.25	17.560	18.50	21.303	21.75	25.045
2.50	2.878	5.75	6.621	9.00	10.363	12.25	14.106	15.50	17.848	18.75	21.590	22.00	25.333
2.75	3.166	6.00	6.909	9.25	10.651	12.50	14.393	15.75	18.136	19.00	21.878	22.25	25.621
3.00	3.454	6.25	7.196	9.50	10.939	12.75	14.681	16.00	18.424	19.25	22.166	22.50	25.909
3.25	3.742	6.50	7.484	9.75	11.227	13.00	14.969	16.25	18.712	19.50	22.454	22.75	26.196
3.50	4.030	6.75	7.772	10.00	11.515	13.25	15.257	16.50	18.999	19.75	22.742	23.00	26.484
3.75	4.318	7.00	8.060	10.25	11.803	13.50	15.545	16.75	19.287	20.00	23.030	23.50	27.000
4.00	4.606	7.25	8.348	10.50	12.090	13.75	15.833	17.00	19.575	20.25	23.318	24.00	27.636

* The slight difference between this measurement and that on p. 158 is not worth considering.

BOAT CARRYING CAPACITY.

To find the approximate cubic capacity of a boat, measure the length and breadth outside and the depth inside. Multiply them together and by .6: the product is the capacity of the boat in cubic feet.

Ten cubic feet capacity is allowed for each person in a boat.

IRON WATER TANKS—DIMENSIONS AND WEIGHT.

No.	Gallons.	Length.	Breadth.	Depth.	Weight.		
		Ft. In.	Ft. In.	Ft. In.	Cwt.	Qr.	Lb.
1	600	4 0	4 0	6 0	10	1	14
2	500	4 0	4 0	5 0	8	2	16
3	400	4 0	4 0	4 0	6	3	25
4	200	4 0	2 0	4 0	4	2	25
5	200	4 0	4 0	2 0	4	2	25
6	193	4 0	4 0	2 0	5	1	20
7	200	3 3	3 3	3 3	4	2	25
8	100	3 3	1 8	3 3	2	3	20
9	100	3 3	3 3	1 9	2	3	20
10	375	4 0	4 0	4 0	6	2	25
11	264	4 0	3 6	4 0	5	2	2
12	110	3 3	2 6	2 10	3	0	6

CASK MEASUREMENTS.

To calculate the capacity of a cask, multiply half the sum of the areas of the two interior circles, viz.: at the bung and head by the interior length, for the contents in cubic inches, which sum, divided by 227.27 (the number of cubic inches in a gallon), reduces the result to that measure.

COMPARISON of the CENTIGRADE, FAHREN- HEIT, and RÉAUMUR THERMOMETERS

$$F = \frac{9}{5} C + 32 = \frac{9}{5} R + 32 \quad R = \frac{5}{9} (F - 32) = \frac{5}{9} C$$

Cent.	Fahr.		Cent.	Fahr.		Réaum.	Cent.	Fahr.		Réaum.	Cent.	Fahr.		Réaum.	Deg.	Réaum.
	Deg.	+100		Deg.	+100			Deg.	+100			Deg.	+100			
+75	157	60	33	91.4	26.6	26.6	9	93.2	27.2	27.2	8	95.8	28.2	28.2	7.2	28.2
+76	160	61	34	93.2	27.2	27.2	10	95.8	28.2	28.2	9	98.2	29.2	29.2	8.8	29.2
+77	163	62	35	95.8	28.2	28.2	11	98.2	29.2	29.2	10	100.6	30.2	30.2	10.4	30.2
+78	166	63	36	98.2	29.2	29.2	12	100.6	30.2	30.2	11	103.0	31.2	31.2	12.0	31.2
+79	169	64	37	100.6	30.2	30.2	13	103.0	31.2	31.2	12	105.4	32.2	32.2	13.6	32.2
+80	172	65	38	103.0	31.2	31.2	14	105.4	32.2	32.2	13	107.8	33.2	33.2	15.2	33.2
+81	175	66	39	105.4	32.2	32.2	15	107.8	33.2	33.2	14	110.2	34.2	34.2	16.8	34.2
+82	178	67	40	107.8	33.2	33.2	16	110.2	34.2	34.2	15	112.6	35.2	35.2	18.4	35.2
+83	181	68	41	110.2	34.2	34.2	17	112.6	35.2	35.2	16	115.0	36.2	36.2	20.0	36.2
+84	184	69	42	112.6	35.2	35.2	18	115.0	36.2	36.2	17	117.4	37.2	37.2	21.6	37.2
+85	187	70	43	115.0	36.2	36.2	19	117.4	37.2	37.2	18	119.8	38.2	38.2	23.2	38.2
+86	190	71	44	117.4	37.2	37.2	20	119.8	38.2	38.2	19	122.2	39.2	39.2	24.8	39.2
+87	193	72	45	119.8	38.2	38.2	21	122.2	39.2	39.2	20	124.6	40.2	40.2	26.4	40.2
+88	196	73	46	122.2	39.2	39.2	22	124.6	40.2	40.2	21	127.0	41.2	41.2	28.0	41.2
+89	199	74	47	124.6	40.2	40.2	23	127.0	41.2	41.2	22	129.4	42.2	42.2	29.6	42.2
+90	202	75	48	127.0	41.2	41.2	24	129.4	42.2	42.2	23	131.8	43.2	43.2	31.2	43.2
+91	205	76	49	129.4	42.2	42.2	25	131.8	43.2	43.2	24	134.2	44.2	44.2	32.8	44.2
+92	208	77	50	131.8	43.2	43.2	26	134.2	44.2	44.2	25	136.6	45.2	45.2	34.4	45.2
+93	211	78	51	134.2	44.2	44.2	27	136.6	45.2	45.2	26	139.0	46.2	46.2	36.0	46.2
+94	214	79	52	136.6	45.2	45.2	28	139.0	46.2	46.2	27	141.4	47.2	47.2	37.6	47.2
+95	217	80	53	139.0	46.2	46.2	29	141.4	47.2	47.2	28	143.8	48.2	48.2	39.2	48.2
+96	220	81	54	141.4	47.2	47.2	30	143.8	48.2	48.2	29	146.2	49.2	49.2	40.8	49.2
+97	223	82	55	143.8	48.2	48.2	31	146.2	49.2	49.2	30	148.6	50.2	50.2	42.4	50.2
+98	226	83	56	146.2	49.2	49.2	32	148.6	50.2	50.2	31	151.0	51.2	51.2	44.0	51.2
+99	229	84	57	148.6	50.2	50.2	33	151.0	51.2	51.2	32	153.4	52.2	52.2	45.6	52.2
+100	232	85	58	151.0	51.2	51.2	34	153.4	52.2	52.2	33	155.8	53.2	53.2	47.2	53.2

WEATHER WARNINGS

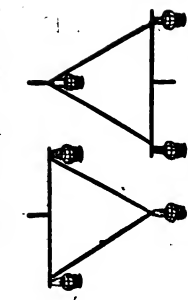
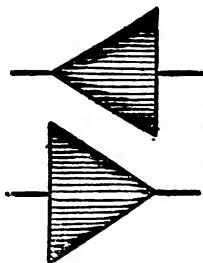
CAUTIONARY STORM SIGNALS

DAY SIGNALS.

SOUTH COAST NORTH COAST

NIGHT SIGNALS.

THREE LANTERNS IN TRIANGLE.



Indicating Gales probably from the South and North.

Used instead of the Cone.

TELEGRAPHIC WEATHER INTELLIGENCE.

The Meteorological Office issue (free of charge) to ports and fishing stations approved of by the Board of Trade notices of atmospheric disturbances on or near the coasts of the British Islands.

SIGNALS.—On receipt at any station of a notice a signal is hoisted, and remains hoisted only during the day-time for forty-eight hours, counting from the time when such message was sent from London, unless orders have been received previously to the contrary.

At dusk, whenever a signal ought to be flying if it were daylight, a night signal may be hoisted in place of the Cone, consisting of three lanterns hung on a triangular frame, point downwards or point upwards as the case may be. It is not considered necessary to hoist lanterns to represent the *Drum*. They should be kept burning until late in the evening, say 9 or 10 o'clock.

No warning messages can be issued on Sundays, so that the signal must sometimes be kept flying on Sundays longer than is necessary. Storms, first showing signs of their approach on Sunday, will sometimes come on before Monday, so that the warning cannot be issued in time to be of service.

STATIONS.—Signals of these signals is intended as a sign that there is an atmospheric disturbance in existence, which will probably cause some danger to the quarter indicated by the signal used in the neighbourhood (say within a distance of fifty miles) of the place where the signal is hoisted. Its meaning is simply, "Look out! It is probable that bad weather is approaching you." In every case some of the principal reasons which lead to the hoisting of the signal are explained in the telegram, which should be posted up for public inspection when the signal is flying.

The signals are made by means of two canvas shapes—a *CONE* and a *DRUM*. The *Cone* is three feet high and three feet wide at the base, and appears as a triangle when hoisted.

GALE.—The *Cone* point downwards means that strong winds are probable from the South and the *Drum* point downwards means that strong winds are probable from the Northward (from N.W. round by N. to S.E.).

The office also issue instruments on loan to meteorological observers at sea.

TABLE FOR CORRECTING WIND FORCE.

2 Points.					4 Points.					6 Points.					8 Points.				
Speed of the Vessel in Knots.		6	8	10	12	Speed of the Vessel in Knots.		6	8	10	12	Speed of the Vessel in Knots.		6	8	10	12		
Velocity of Wind registered by Gauge.		Correction in Miles.				Velocity of Wind registered by Gauge.		Correction in Miles.				Velocity of Wind registered by Gauge.		Correction in Miles.					
Miles per Hour.		-5½	-7	-9	-11	Miles per Hour.		-5	-6	-8	-10	Miles per Hour.		-3	-5	-6	-7		
16	-5	-7	-9	-11	-13	16	-5	-6	-8	-10	-12	16	-3	-4	-5	-6	-7		
24	-5	-7	-9	-11	-13	24	-5	-6	-8	-10	-12	24	-3	-4	-5	-6	-7		
32	-5	-7	-9	-11	-13	32	-5	-6	-8	-10	-12	32	-3	-4	-5	-6	-7		
40	-5	-7	-9	-11	-13	40	-5	-6	-8	-10	-12	40	-3	-4	-5	-6	-7		
48	-5	-7	-9	-11	-13	48	-4	-6	-8	-10	-12	48	-3	-4	-5	-6	-7		
56	-5	-7	-9	-11	-13	56	-4	-6	-7	-9	-11	56	-2½	-3	-4	-5	-6		

10 Points.					12 Points.					14 Points.							
Speed of the Vessel in Knots.		6	8	10	12	Speed of the Vessel in Knots.		6	8	10	12	Speed of the Vessel in Knots.		6	8	10	12
Velocity of Wind registered by Gauge.		Correction in Miles.				Velocity of Wind registered by Gauge.		Correction in Miles.				Velocity of Wind registered by Gauge.		Correction in Miles.			
Miles per Hour.		+1	+1½	+2	+2½	Miles per Hour.		+3½	+4½	+5½	+6½	Miles per Hour.		+3½	+4½	+5½	+6½
16	+1	+1½	+2	+2½	+3	16	+3½	+4½	+5½	+6½	+7½	16	+3½	+4½	+5½	+6½	+7½
24	+1	+1½	+2	+2½	+3	24	+4	+5	+6	+7	+8	24	+6	+7	+8	+9	+10
32	+2	+2½	+3	+3½	+4	32	+4½	+5½	+6½	+7½	+8½	32	+6	+7	+8	+9	+10
40	+2	+2½	+3	+3½	+4	40	+5	+6	+7	+8	+9	40	+6	+7	+8	+9	+10
48	+2	+2½	+3	+3½	+4	48	+5½	+6½	+7½	+8½	+9½	48	+6	+7	+8	+9	+10
56	+2	+2½	+3	+3½	+4	56	+6	+7	+8	+9	+10	56	+6	+7	+8	+9	+10

NOTE.—Look in the Table, under angle in points between wind's true direction and ship's head, then under rate of vessel at time in knots per hour, with the velocity of wind per hour as shown by gauge, take out correction to be applied as sign directs. The result is the wind's true velocity.

EXAMPLE.—Ship steering East, wind's true direction South, gives angle 8 points; velocity of wind registered by Anemometer 24, and speed of ship 10 knots, gives correction—2 to be applied to the 24, so that the wind's true velocity equals 22.

For Paper by D. Wilson-Barker on "Notes on Taking Meteorological Observations on Board Ship," see *Quarterly Journal*,
Royal Meteorological Society, vol. xlii.

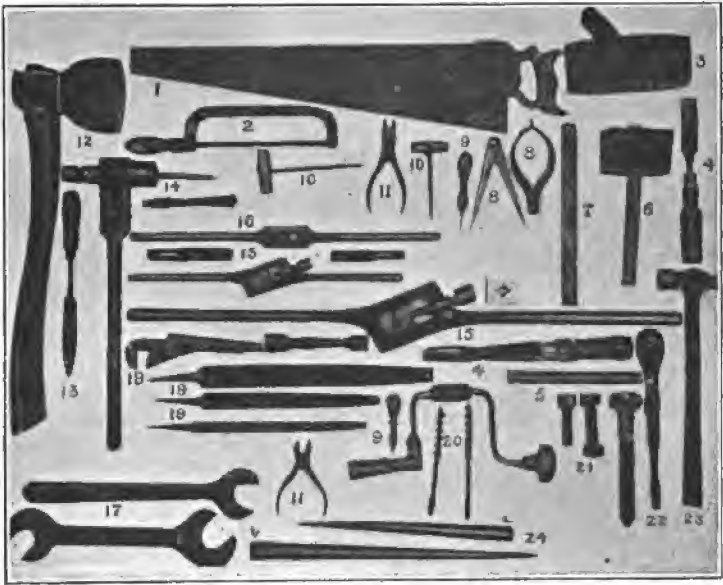


PLATE XXIV.—GENERAL TOOLS IN USE ON BOARD SHIP.

Seamen are now constantly called upon to handle all kinds of tools, and it behoves them to know all about different implements and their uses. A plate of illustration is given here.

- | | | |
|------------------------------------|----------------------------|---------------------------------------|
| 1. Saw. | 10. Gimlets. | 19. Files. |
| 2. Hacksaw. | 11. Pliers or pinchers. | 20. Brace and bits. |
| 3. Plane. | 12. Axe. | 21. Screw bolt, stud and coach screw. |
| 4. Chisels. | 13. Soldering iron. | 22. Screwdriver. |
| 5. Cold chisels. | 14. Ratchet brace and bit. | 23. Hammer. |
| 6. Mallet. | 15. Stock and dies. | 24. Marline spikes |
| 7. Scale. | 16. Tap-wrench. | <i>a</i> = ordinary. |
| 8. Callipers (inside and outside). | 17. Spanners. | <i>b</i> = for wire. |
| 9. Bradawl. | 18. Shifting spanner. | |

A GLOSSARY

OF

SEA TERMS AND PHRASES.*

A.—The class of the excellence of sea-going merchant ships on Lloyd's books, subdivided into 100 A1, 90 A1, &c., 100 A. being the highest class. The difference is chiefly due to thickness of plating, or to age. A small letter inside the A., thus A1 or A1, indicates a finer classification of each section in accordance with certain rules laid down. Coasting vessels and special service vessels are classed under different characters.

A. B.—The rating of able seamen on the ship's books; these two letters are often used as an epithet for the person so rated. He must be equal to all the duties required of a seaman in a ship, not only as regards the saying "to hand, reef and steer," but also to strop a block, splice, knot, turn in rigging, and be an example to the ordinary seaman and landsman.

Aback.—The situation of a ship's sails when the wind bears against their front surfaces.

Abaft.—This word, generally speaking, means behind, inferred relatively, beginning from the stem and continuing towards the stern, that is, the hinder part of the ship. Abaft the beam implies any direction between a supposed transverse line amidships and the stern, whether in or out of the ship. It is the relative situation of an object with the ship, when that object is placed in the arc of the horizon contained between a line at right angles with the keel and the point of the compass, which is directly opposite the ship's course. An object—as a man overboard—is described by the look-out man at the masthead as abeam, before, or abaft the beam, by so many points of the compass; or as a vessel seen may be "three points before the beam," &c.

Abeam.—In a line at right angles to the vessel's length; opposite the centre of a ship's side.

Abreast.—Side by side, parallel, or opposite to; generally used in opposition to abaft or afore. Abreast of a place is directly off it, a direction at right angles with the keel or ship's length.

A-Burton.—The situation of casks when they are stowed in the hold athwartship, or in a line with the beam.

* By kind permission of Messrs. Blackie and Son, I am able to make many extracts from Admiral Smyth's admirable "Sailor's Word-Book."

A-cockbill.—When the anchor hangs by its ring at the cat-head in a position for dropping.

Adrift.—Floating at random; the state of a boat or vessel broken from her moorings, and driven to and fro without control by the winds and waves. Cast loose, cut adrift.

Ad Valorem.—According to value.

Afloat.—Borne up and supported by the water; buoyed clear of the ground; also used for being on board ship.

Aft.—Contradistinctive of fore, and an abbreviation of abaft—the hinder part of the ship, or that nearest the stern. Right aft is in a direct line with the keel from the stern. To haul aft a sheet is to pull on the rope which brings the clew, or corner, of the sails more in the direction of the stern. The mast rakes aft when it inclines towards the stern.

Aground.—The situation of a ship or other vessel whose bottom touches or rests upon the ground. It also signifies stranded, and is issued figuratively for being disabled or hindered.

Ahead.—A term especially referable to any object farther onward, or immediately before the ship, or in the course steered, and therefore opposed to astern. Ahead of the reckoning is sailing beyond the estimated position of the ship.

A-lee.—The contrary of a-weather; the position of the helm when its tiller is borne over to the lee-side of the ship, in order to go about or put her head to windward. "Hard a-lee!" or "luff a-lee!" an order to the steersman to put the helm down. "Helm's a-lee!" the word of command given on putting the helm down, and causing the head-sails to shake in the wind.

Aloft.—Above, overhead, on high. Synonymous with up above the tops, at the masthead, or anywhere about the higher yards, masts, and rigging of ships. "Aloft there!" the hailing of people in the tops. "Away aloft!" the command to the people in the rigging to climb to their stations.

Amidships.—The middle of the ship, whether in regard to her length between stem and stern, or in breadth between the two sides. To put the helm amidships is to place it in a line with the keel.

Anchor Watch.—A subdivision of the watch kept constantly on deck during the time the ship lies at single anchor to be in readiness to hoist jib or staysails, to keep the ship clear of her anchor; or in readiness to veer more cable, or let go another anchor in case the ship should drive or part from her anchor.

Angle Irons.—Certain strips of iron having their edges turned up at an angle to each other; they are of various sizes, and used for the ribs and knees of the framing of iron vessels.

Apeek.—A ship drawn directly over the anchor is apeek; when the fore-stay and cable form a line, it is "short stay" apeek; when in a line with the main-stay, "long stay" apeek. The anchor is apeek when the cable has been sufficiently hove in to bring the ship over it. Yards are apeek when they are topped up by contrary lifts.

Articles.—The express stipulations to which seamen bind themselves by signature on joining a merchant ship.

Astern.—Any distance behind a vessel; in the after-part of the ship; in the direction of the stern, and therefore the opposite of "ahead." To drop astern is to be left behind; when abaft a right angle to the keel at the mainmast she drops astern.

Athwart.—The transverse direction; anything extending across the line of a ship's course. "Athwart hawse," a vessel, boat, or floating lumber accidentally drifted across the stem of a ship, the transverse position of the drift being understood. "Athwart the forefoot," just before the stem; ships fire a shot in this direction to arrest a stranger, and make her bring-to. "Athwart ships," in the direction of the beam; from side to side; in opposition to "fore and aft."

A-trip.—The anchor is a-trip, or a-weigh, when the purchase has just made it break ground, or raised it clear. Sails are a-trip when they are hoisted from the cap, sheeted home, and ready for trimming.

Avast.—The order to stop, hold, cease, or stay in any operation.

Avast Heaving.—The cry to arrest the capstan or winch when nippers are jammed, or any other impediment occurs when heaving in the cable or rope.

A-weather.—The position of the helm when its tiller is moved to the windward side of the ship, in the direction from which the wind blows. The opposite of "A-lee."

A-weigh.—The anchor being a-trip, or after breaking out of the ground.

Ay, ay, Sir.—A prompt reply on receiving an order. Also the answer on comprehending the order.

Back.—To "back an anchor" is to carry a small anchor ahead of the one by which the ship rides, to partake of the strain, and check the latter from coming home. To "back and fill" is to get windward in very narrow channels, by a series of smart alternate boards and backing, with weather tides. To "back a sail" is to brace its yard, so that the wind may blow directly on the front of the sail, and thus retard the ship's course. A sailing vessel is "backed" by means of the sails, a steamer by reversing the paddles or screw-propeller. To "back astern." To impel the water with the oars contrary to the usual mode, or towards the head of the boat, so that she shall recede. To "back the port or starboard oars." To back with the right or left oars only, so as to round suddenly. To "back out." This term is familiarly used for retreating out of a difficulty. To "back a rope or chain" is to put on a preventer when it is thought likely to break from age or extra strain. To "back water." To impel a boat astern, so as to recede in a direction opposite to the former course.

Baffing.—A term applied to the wind when it frequently shifts from one point to another.

Ballast.—A certain portion of stone, pig-iron, gravel, water, or such like materials, deposited in a ship's hold when she either has no cargo or too little to bring her sufficiently low in the water. It is used

to counterbalance the effect of the wind upon the masts, and to give the ship a proper stability, that she may be enabled to carry sail without danger of overturning.

Ballast Ports are square holes cut in the sides of vessels for taking in ballast. They should be securely barred and caulked in before proceeding to sea.

Bank Fires, To.—In steamers, allowing the fires to burn down low, pulling them down to one side of the bridge of the fireplace, and there covering them up with ashes taken from the ash-pit, at the same time nearly closing the dampers in the funnel and ash-pit doors. This, with attention on the part of the engineers, will suffice to maintain the water hot, and a slight pressure of steam in the boilers. When fuel is added and draught induced the fires are said to be "drawn forward," and steam is speedily generated.

Baréca.—A small barrel.

Bare Poles.—The condition of a ship having no sails set when out at sea, and either scudding or lying-to, by stress of weather.

Barratry.—Any fraudulent act of the master or mariners committed to the prejudice of the ship's owners or underwriters, whether by fraudulently losing the vessel, deserting her, selling her, or committing any other embezzlement. The diverting a ship from her right course with evil intent is barratry.

Battens.—In general, scantlings of wood from 1 inch to 3 inches broad. Long slips of fir used for setting fair the sheer-lines of a ship, drawing the lines by in the moulding-loft, or setting off distances. Also, thin strips of wood put upon rigging, to keep it from chafing, by those who dislike mats; when large these are designated "Scotchmen."

Battens of the Hatches.—Long narrow laths of wood or iron, serving by the help of wedges to confine the edges of the tarpaulins, and keep them close down to the sides of the hatchways, in bad weather.

Beacon.—A post or stake erected over a shoal or sandbank, as a warning to seamen to keep at a distance; also a signal mark placed on the top of hills, eminences, or buildings near the shore for the safe guidance of shipping.

Beam-ends.—A ship is said to be on her beam-ends when she has heeled over so much on one side that her beams approach to a vertical position; hence also a person lying down is metaphorically said to be on his beam-ends.

Beating, or Turning to Windward.—The operation of making progress by alternate tacks at sea against the wind, in a zigzag line, or transverse courses; "beating," however, is generally understood to be turning to windward in a storm or fresh wind.

Becalms, To.—To intercept the current of the wind in its passage to a ship, by means of any contiguous object, as a high shore, some other ship to windward, &c. At this time the sails remain in a sort of rest, and are consequently deprived of their power to govern the motion of the ship. Thus one sail becalms another.

Before or Aft the Beam.—The bearing of any object which is before or aft a line at a right angle to the keel, at the midship section of a ship.

Belaying Pins.—Small wooden or iron cylinders, fixed in racks in different parts of the ship, for belaying running ropes to.

Bell.—"Strike the bell." The order to strike the clapper against the bell as many times as there are half-hours of the watch elapsed; hence we say it is two bells, three bells, &c., meaning there are two or three half-hours past.

Belly.—The swell of a sail. To belly a sail is to inflate or fill it with the wind, so as to give it a taut leech.

Bend to.—To fasten one rope to another, or to an anchor, &c.

Bentinck-boom.—A spar used to spread the foot of the foresail in small vessels such as whalers; dispensing with the tack and sheet, a tackle to it amidships keeps the sail properly spread.

Bibbs.—Pieces of iron or steel bolted to the hounds of a mast to support the trestle-trees.

Bight.—The loop of a rope when it is folded; in contradistinction to its ends.

Bilge or Bulge.—That part of the floor in a ship—on either side of the keel—which approaches nearer to a horizontal than to a perpendicular direction, and begins to round upwards.

Bilge Keels are keels bolted on to the bilge of many vessels to make them easier in a seaway by preventing excessive rolling.

Bill of Exchange.—A means of remitting money from one country to another. The receiver must present it for acceptance to the parties on whom it is drawn without loss of time; he may then claim the money after the date specified on the bill has elapsed.

Bill of Health.—A certificate properly authenticated by the consul or other proper authority at any port, that the ship comes from a place where no contagious disease prevails, and that none of the crew at the time of her departure were infected with any such disease. Such constitutes a *clean* bill of health, in contradistinction to a *foul* bill.

Bill of Lading.—A memorandum by which the master of a ship acknowledges the receipt of the goods specified therein, and promises to deliver them, unless the dangers of the sea, fire, or enemies prevent him, in like good condition to the consignee, or his order.

Bill of Sale.—A written document by which the property of a vessel, or shares thereof, are transferred to a purchaser.

Binnacle.—The case in which the compass is kept to preserve it from injury.

Binnacle Light.—The oil or electric lamp which illuminates the compass card in the binnacle.

Bitts.—A frame composed of two strong pieces of straight oak timber, fixed upright in a ship, and bolted securely to the beams, whereon to fasten the cables or other ropes; also iron or steel cylindrical castings bolted in places about the decks.

Blacking Down.—The tarring and blacking of rigging; or the operation of blacking the ship's sides with tar or mineral blacking.

Block and Block.—The situation of a tackle when the blocks are drawn close together.

Blue Pigeon.—A nickname for the sounding lead.

Board.—The space comprehended between any two places when the ship changes her course by tacking; or, it is the line over which she runs between tack and tack when working to windward, or sailing against the direction of the wind. To make "a good board." To sail in a straight line when close hauled without deviating to leeward. To make "short boards" is to tack frequently before the ship has run any great length of way. To make a "stern board," is when by a current, or any other accident, the vessel comes head to wind, the helm is shifted, and she has fallen back on the opposite tack, losing what she had gained, instead of having advanced beyond it. (See *Stern Board*.) The word board has various other applications among seamen. To "go aboard" signifies to go into the ship. To "slip by the board" is to slip down a ship's side. To "board it up" is to beat up, sometimes on one tack, and sometimes on another. The "weather-board" is the side of the ship which is to windward. "By the board" means close to a ship's deck.

Boat-checks.—Clamps of wood upon which a boat resta when stowed on a vessel's deck.

Boat Davit.—A curved piece of timber or iron with a sheave at its outer end, which projects over the boat's stern, while the inner end is shipped into a cleat on each side of the bottom of the boat, for weighing anchors when needed.

Boatswain.—The officer who superintends the boat sails, ship sails, rigging, canvas, colours, anchors, cables, and cordage, committed to his charge. He ought also to take care that the blocks and running ropes are regularly placed to answer the purposes for which they are intended, and that the sails are properly fitted to their yards and stays and well furled or reefed, when occasion requires. He pipes the hands to their several duties, and sees that they attend to his call; he ought to be in every way a thorough seaman. Although termed boatswain, the boats are not in his charge. They, with the spars, &c., and stores for repair, belong to the carpenter.

Boatswain's Mate is an assistant to the boatswain.

Boat the Oars.—Put them in their proper places fore and aft on the thwarts ready for use.

Bobstay Plates.—Iron plates by which the lower end of the bobstay is attached to the stem.

Body Plan.—The draught of a proposed ship, showing the breadth and timbers; it represents a section through the broadest part of the vessel; it is otherwise called the plan of projection.

Bollard.—A strong piece of iron or steel fixed to the deck round which to make a hawser or chain fast.

Boisters.—Small cushions or bags of tarred canvas used to preserve the stays from being chafed by the motion of the masts, when the ship

itches at sea. Pieces of soft wood covered with canvas, placed on the trestle-trees, for the eyes of the rigging to rest upon, and to prevent a sharp nip.

Bolt.—A cylindrical pin of iron or copper to unite the different parts of a vessel, varied in form according to the places where they are required.

Bond of Bottomry.—An authority to borrow money by pledging the keel or bottom of the ship; that is, the ship itself.

Booby-hatch.—A smaller kind of companion, but readily removable; it is in use for half-decks, and lifts off in one piece.

Boom.—A long spar run out from different places in the ship, to extend or boom out the foot of a particular sail; as, jib-boom, flying jib-boom, studding-sail booms, driver or spanker boom, main boom, square-sail boom, &c. A ship is said to come "booming forwards" when she comes with all the sail she can make. Boom also denotes a cable stretched athwart the mouth of a river or harbour with yards, topmasts, or stout spars of wood lashed to it, to prevent the entrance of an enemy. To "top one's boom" is to start off. To "boom off" is to shove a boat or vessel away with spars.

Bore.—A sudden and rapid flow of tide in certain inlets of the sea.

Bottomree, or Bottomry Bond.—The contract of bottomry is a negotiable instrument, which may be put in suit by the person to whom it is transferred; it is in use in all countries of maritime commerce and interests. A contract in the nature of a mortgage of a ship, when the owner of it borrows money to enable him to carry on the voyage, and pledge the keel or bottom of the ship, as a security for the repayment. If the ship be lost, the lender loses all his money; but if it return in safety, then he receives back both the principal and the premium stipulated to be paid, however much it may exceed the usual or legal rate of interest. The affair is, however, only regarded as valid upon the ground of necessity; for, although more than the interest allowed by law may be exacted, it is not deemed to be usury.

Bout.—"Bout ship," the brief order for "about ship."

Bow.—The fore end of a ship or boat.

Bower Anchors.—The anchors at the bows and in constant working use.

Bowse, To.—To pull upon any body with a tackle to haul it taut.

Box the Compass, To.—Signifies the ability to repeat the names of the thirty-two points in order both forwards and backwards, as also to answer any and all questions respecting the divisions of the compass-card.

Break-off.—Applied only when the wind will not allow of keeping the course.

Breast Hook.—A plate which joins the panting stringers inside the stem.

Bring-to, To.—To check the course of a ship by trimming the sails so that they shall counteract each other and keep her nearly stationary; she is then said to lie by, or lie-to, or heave-to. "Bring to an anchor." The act of anchoring a vessel.

Broach-to, To.—To fly up into the wind. It generally happens when a ship is carrying a press of canvas with the wind on the quarter, and a good deal of after-sail set. The masts are endangered by the course being altered, since by bringing it more in opposition to the wind, the pressure of the wind on the sails is thereby increased. In extreme cases the sails are caught flat aback; in such case the masts are likely to give way, or the ship to go down stern foremost.

Broad Arrow.—The royal mark for government stores of every description.

Brokerage.—Commissions charged for securing and transacting business for ships.

Brow.—An inclined plane of planks, on one or both sides of a ship, to communicate internally; a stage gangway for the accommodation of the shipwrights, in conveying planks, timber, or weighty articles on board. Also, the face of a rising ground. An old term for a gang-board.

Buckle.—A mast buckles when it suffers by compression, so that the fibre takes a sinuous form, and the grain is upset; also, in Polar regions, the bending or arching of the ice upwards, preceding a ship.

Bull Rope.—A rope rove through a block in the bowsprit and bent to a buoy the ship is moored to, to keep the buoy clear of the stem. A rope used to clear a foul anchor.

Bull's-eyes.—A flat circular piece of hard wood with a groove round the outside and a smooth hole through the centre for taking a rope through. Used in sails for receiving buntlines, &c., through them.

Bumkin, Bumpkin, or Boomkin.—A short boom or beam of metal or timber projecting from a ship. It is used to lead braces, &c., to.

Bung-up and Bilge-free.—A cask so placed that its bung-stave is uppermost, and it rests entirely on its beds.

Bunker.—The space allotted for stowing coal in steamers.

Buoy.—A sort of close cask, or block of wood, fastened by a rope to the anchor, to show its position. To "stream the buoy" is to let it fall from the ship's side into the water, which is always done before the anchor is let go, that it may not be fouled by the buoy-rope as it sinks to the bottom. Buoys of various kinds are also placed upon rocks or sand-banks to direct mariners where to avoid danger.

Buoy Watching.—The anchor buoy being in its right place over the anchor.

Butt.—The joining of two timbers or planks endways. In iron ships the end of the skin plates.

By.—On or close to the wind. "Full and by," not to lift or shiver the sails; rap-full.

By the Board.—Over the ship's side. When a mast is carried away near the deck it is said to "go by the board."

By the Head.—When a ship is deeper forward than aft.

By the Lee.—The situation of a vessel going free, when she has fallen off so much as to bring the wind round her stern, and to take her sails aback on the other side.

By the Stern.—When the ship draws more water aft than forward (See *By the Head*.)

By the Wind is when a ship is sailed as nearly to the direction of the wind as possible.

Cable's Length.—A measure of about 101 fathoms, or $\frac{1}{10}$ of a nautical mile.

Call, or Pipe.—A peculiar silver pipe or whistle, used by the boatswain and his mates to attract attention.

Camber.—The round upon the upper deck; the curve of a ship's plank.

Can Hooks.—They are used to sling a cask, by the chimes or ends of its staves, and are formed by reeving the two ends of a piece of rope or chain through the eyes of two flat hooks, and then making them fast. The tackle is then hooked to the middle of the bight.

Cant, To.—To turn anything about, so that it does not stand square.

Capstan, Cabestan, Capstern, Capston, &c.—A mechanical arrangement for lifting great weights, usually the anchors.

Capstan Bars.—Long pieces of wood of the best ash or hickory, one end of which is thrust into the square holes in the drum head, like the spokes of a wheel. They are used to heave the capstan round, by the men setting their hands and chests against them, and walking round.

Careening.—The operation of heaving the ship down on one side.

Cast of the Lead.—The act of heaving the lead into the sea to ascertain what depth of water there is.

Cat's-paw.—A light air perceived at a distance in a calm by the impressions made on the surface of the sea, which it sweeps very gently, and then passes away, being equally partial and transitory.

Caulking.—Forcing a quantity of oakum, or old ropes untwisted and drawn asunder, into the seams of the planks.

Centre of Cavity, of Displacement, or of Immersion, are terms in naval architecture for the mean centre of that part of a vessel which is immersed in the water. The centre of buoyancy, or that support given to a ship by the water on which she is immersed, coincides with the centre of cavity, &c.

Certificate.—A voucher or written testimony to the truth of any statement.

Chafe, To.—To rub or fret the surface of a rope, mast, or yard, by the motion of the ship or otherwise, against anything that is too hard for it. "Chafing-gear" is the stuff put upon the rigging and spars to prevent their being chafed.

Charter.—To charter a vessel is to take her to freight under a charter par.y.

Charter Party.—The deed or written contract between the owners and the merchants for the hire of a ship, and safe delivery of the cargo.

Check.—To slack off a rope a little, and belay it again.

Cheeks of the Mast.—The faces of projecting parts on each side of the masts, formed to sustain the trestle-trees upon which the frame of the top, together with the topmast, immediately rest.

Chine and Chine.—Casks stowed end to end.

Choke the Luff.—To place suddenly the fall of a tackle close to the block across the jaw of the next turn of the rope in the block, so as to prevent the leading part from rendering.

Clap on !—The order to lay hold of any rope, in order to haul upon it.

Clearance.—The document from the Customs, by which a vessel and her cargo, by entering all particulars at the Custom House and paying the dues, is permitted to clear out or sail.

Close-hauled.—The general arrangement or trim of a ship's sails when she endeavours to progress in the nearest direction possible contrary to the wind.

Close-reefed.—When under lower tops'ls and fores'l.

Coamings of the Hatches or Gratings.—Certain raised work about the edges of the hatch-openings of a ship, to prevent the water on deck from running down.

Coat.—A piece of tarred canvas nailed or secured round about the partners, or that part where the mast or bowsprit enters the deck. Its use is to prevent the water from running down between decks.

Cock Bill.—The situation of the anchor when suspended from the cat-head ready for letting go.

Coil.—A certain quantity of rope laid up in ring fashion.

Companion.—A hatchway with a house or large fixed hatch over it to admit of entrance.

Company.—The whole crew of any ship, including her officers, men and boys.

Counter-sunk.—Those holes which are made for the heads of bolts, rivets or nails to be sunk in, so as to be even with the general surface.

Crane-lines.—Small lines for keeping the lee backstays from chafing against the yards.

Crank, or Crank-sided, is applied to a vessel which, by her construction or her stowage, is inclined to lean over a great deal; or which, from insufficient ballast or cargo, is incapable of carrying sail, without danger of overturning. The opposite term is "stiff," or the quality of standing well up to her canvas.

Crank-shaft conveys the power from the connecting-rod to the propeller shaft.

Crow-foot.—A number of small lines spreading out from an arrow or long block, used to suspend the awnings by.

Crow's Nest.—A small shelter placed at the masthead of whalers for the lookout-man or ice-master.

Davit.—A piece of timber or iron, with sheaves or blocks at its end, projecting over a vessel's side to hoist up and suspend one end of a boat or anchor.

Dead Horse.—A term applied by seamen to labour which has been paid for in advance.

Dead Men.—The reef or gasket-ends carelessly left dangling under the yard when the sail is furled, instead of being tucked in. The cut rovings in an unbent sail.

Dead Water.—The eddy-water under the counter of a ship under way; it is so called because it passes away slower than the water alongside.

Dead Weight.—A vessel's lading when it consists of heavy goods, but particularly such as pay freight according to their weight and not their measurement. All above the equipped weight of a vessel.

Debenture.—Acknowledgment of a debt.

Demurrage.—Compensation for the undue delay or detention of a vessel.

Derelict.—An abandoned vessel.

Ditty Bag.—It is in use among seamen for holding their necessities.

Dock.—An artificial receptacle for shipping in which they can discharge or take in cargo and refit.

Dock Dues.—The charges made upon shipping for the use of docks.

Draught, or Draft.—The depth of water a ship displaces, or of a body of fluid necessary to float a vessel, hence a ship is said to draw so many feet of water when she requires that depth to float her; this is, for convenience, marked on the stem and stern-post from the keel upwards, in figures which are usually 6 inches long and 6 inches apart, the bottom of the figures representing the depth.

Drawback.—An allowance by the government under which duties paid are returnable wholly or in part.

Drift.—The altered position of a vessel by current, or falling to leeward when hove-to or lying-to in a gale, when but little headway is made by the action of sails.

Drive, To.—A ship drives when her anchor trips or will not hold.

Drogue.—A spar or sea anchor used to lay a boat to at sea, or to prevent her being driven in on a beach too quickly, by hanging it over the stern to a line.

Dry Dock. (See *Graving Dock*.)

Dunnage.—Loose wood or other substances, as horns, rattan, coir, bamboo, &c., to stow amongst casks and other cargo to prevent their motion, and keep them free from bilge-water or sweat.

Embargo.—A temporary junction or arrest laid on ships or merchandise by public authority.

Entrance.—A term for the bow of a vessel. That part of the fore-part of the ship from the cutwater to the part it swells out to the full beam of the ship.

Fair-lead.—Those ropes which, suffering the least friction in a block, are said to "lead fair." Pieces of wood with holes in them to fix on to rigging, through which to lead ropes.

Fenders are lengths of spars cut up, or bundles of faggots tied together and hung over the ship's side to prevent chafing against another vessel or against a wharf. The fenders of a boat are usually made of canvas, stuffed and neatly painted.

Fid.—A square bar of wood or iron, with a shoulder at one end, used to support the weight of a topmast when erected at the head of the lower mast, by passing through a mortise or hole at the lower end of the former, and resting its ends on the trestle-trees, which are sustained by the head of the latter; the fid, therefore, must be withdrawn every time the mast is lowered; the topgallant-mast is retained at the head of the topmast in the same manner. A kind of wooden marline-spike.

Fidley.—The iron casing enclosing the part of the funnel where it goes through the upper deck and generally covering all this part over the boilers.

Flake, To, a rope down, is to put it in long oblong coils partly covering one another.

Flat-aback.—When all the sails are blown with their after-surface against the mast, so as to give sternway.

Flatten In, To.—The action of hauling in the aftmost clew of a sail to give it greater power of turning the vessel.

Flemish, To.—To coil down a rope concentrically in the direction of the sun, or coil of a watch-spring, beginning in the middle without ridgers; but if there must be riding fakes they begin outside; the latter is the true French coil.

Flemish Horse is the outer, short foot-rope for the man at the earing of a square sail.

Floor.—The bottom of a vessel on each side of the keelson. When used in a strict sense, it is only so much of her bottom as she rests upon when aground. Such ships as have long and withal broad floors lie on the ground with most security, whereas others which are narrow in the floor fall over on their sides and are apt to break their timbers.

Flotsam.—Goods floating from a wreck.

Fore-foot.—The foremost piece of the keel, or timber which terminates the keel at the forward extremity, and forms a rest for the stem's lower end; it is connected by a scarph to the extremity of the keel; the other end of it, which is incurvated upwards into a sort of knee, is scarphed to the lower end of the stem; it is also called the gripe. As the lower arm of the fore-foot lies on the same level with the keel, so the upper one coincides with the middle line of the stem; its breadth and thickness therefore correspond with the dimensions of those pieces, and the heel of the cut-water is scarphed to its upper end,

Forthering is usually practised to stop a leak at sea. A heavy sail, as the sprit-sail, is closely thrummed with yarn and oakum, and drawn under the bottom; the pressure of the water drives the thrumming into the apertures.

Freight of a ship.—The hire, or part thereof, usually paid for the carriage and conveyance of goods by sea, or the sum agreed upon between the owner and the merchant for the hire and use of a vessel, at the rate of so much for the voyage, or by the month, or per ton.

Freshen the Nip, To.—To veer a small portion of a cable through the hawse-hole, or heave a little in, in order to let another part of it bear the stress and friction.

Full and By.—Sailing close-hauled on a wind.

Futtock-shrouds, or foot-hook shrouds, are short pieces of rope or chain which secure the lower dead-eyes and futtock-plates of topmast rigging to a band round a lower mast.

Gangway.—That part of a ship's side, and opening in her bulwarks, by which persons enter and depart, provided with a sufficient number of steps, or cleats, nailed upon the ship's side, nearly as low as the surface of the water, and sometimes furnished with a railed accommodation-ladder projecting from the ship's side, and secured by iron braces.

Garboard-strake, or **Sand-streak.**—The first range of plating laid upon a ship's bottom, next the keel, to which it is riveted.

Gasket.—A cord, or piece of plaited or other stuff, to secure furled sails to the yard.

Gear.—A general name for the rigging of any particular spar or sail.

General Average.—A claim made upon the owners of a ship and her cargo when the property of one or more has been sacrificed for the good of the whole.

Going Free.—Sailing with the wind abeam.

Grafting.—An ornamental weaving of fine yarns, &c., over the stop of a block; or applied to the tapered ends of the ropes, and termed pointing.

Grapnel, or **Grapling.**—A small anchor for boats, having a ring at one end, and four palmed claws at the other.

Gratings.—An open wood-work of cross-battens and ledges forming cover for the hatchways, serving to give light and air to the lower decks.

Graving Dock, or **Dry Dock.**—An artificial receptacle used for the inspecting, repairing and cleaning a vessel's bottom.

Gripes.—A broad plait formed by an assemblage of ropes, woven and fitted with thimbles and lanyards, used to steady the boats when hung in the davits, or upon the deck of a ship at sea. The gripes are fastened at their ends to ring-bolts in the deck, on each side of the boat, whence, passing over her middle and extremities, they are set up by means of the lanyards.

Ground, To.—To take the bottom, or shore; to be run aground through ignorance, violence or accident.

Ground Swell.—A sudden swell preceding a gale, which rises along shore, often in fine weather, and when the sea beyond it is calm.

Guess-warp, or Guest-rope.—A rope carried to a distant object, in order to warp a vessel towards it, or to make fast a boat.

Guy.—A rope used to steady a weighty body from swinging against the ship's side while it is hoisting or lowering, particularly when there is a high sea. Also a rope extended from the head of sheers, and made fast at a distance on each side to steady them.

Hailing.—To call another vessel.

Hand.—A term often used for the word "man."

Handspike.—A wooden lever about 6 feet long, square at one end and round at the other. Used for moving any heavy articles about the deck, &c.

Hanks.—Hoops or rings of rope, wood or iron, fixed upon the stays, to seize the luff of fore-and-aft sails, and to confine the staysails thereto at different distances.

Harbour Log.—That part of the log-book which consists solely of remarks, and which relates only to transactions while the ship is in port.

Harbour Watch.—A division or subdivision of the watch kept on night duty, when the ship rides at right anchor to meet any emergency.

Hard a-lee.—The situation of the tiller when it brings the rudder hard over to windward.

Harness Cask.—A large conical tub for containing the salt provisions intended for present consumption.

Hatchway.—A square or oblong opening in the middle of the deck of a ship.

Haul, To.—An expressing peculiar to seamen, implying to pull or bowse at a single rope, without the assistance of blocks or other mechanical powers upon it.

Hawse Holes.—Cylindrical holes cut through the bows of a ship on each side of the stem, through which the cables pass.

Head to Wind.—The situation of a ship or boat when her head is pointed directly to windward.

Heart.—A block of wood or piece of metal forming a peculiar sort of triangular dead-eye, somewhat resembling the shape of a heart; it is furnished with only one large hole in the middle, grooved for the rope, instead of the three holes. It is principally attached to the stays, as the dead-eyes are to the shrouds.

Heel of a Mast.—The lower end which either fits into the step attached to the keel, or in topmasts is sustained by the fid upon the trestle-trees.

Hogged.—A significant word derived from the animal; it implies that the two ends of a ship's deck droop over than the midship part,

consequently, that her keel and bottom are so strained as to curve upwards. The term is therefore in opposition to that of "sagging."

Hoist, or Hoise, To.—To raise anything.

Horns.—The points of the jaws of booms or gaffs. Also the outer ends of the cross-trees.

Housing, or House-line.—A small line formed of three fine strands, smaller than rope yarn; principally used for seizings of the block-strops, fastening the clews of sails to their bolt-ropes, and other purposes. (See *Marline*.)

Housing of a Lower Mast.—That part of a mast which is below deck to the step in the keelson; of a bowsprit, the portion within the knight-heads.

Hove Down.—The situation of a ship when heeled or placed thus for repairs.

Hove Short.—The ship with her cable hove taut towards her anchor

Hove-to.—From the act of heaving-to; the motion of the ship stopped.

Hug, To.—To hug the land is to sail as near it as possible, the land, however, being to windward. To hug the wind is to keep the ship as close-hauled to the wind as possible.

Hypothecation.—An authority to the master, amounting almost to a power of the absolute disposal of the ship; in a foreign country he may hypothecate not only the hull, but his freight and cargo, for necessary and urgent repairs.

Indicator.—An instrument by means of which the varying pressures in the cylinders can be obtained.

Injection Pipe.—This is fixed in the interior of a marine steam-engine, is fitted with a cock, and communicates with the water outside; it is for the purpose of playing into the condenser while the engine is working, and creating a vacuum.

Invoice.—A description of goods consigned.

Irons.—A ship is said to be in irons when, by mismanagement, she is permitted to come up in the wind and lose her way, rendering it difficult to throw the ship's head off on either tack, and so incurring the danger of making a stern board.

Jag.—To stop up running rigging to the shrouds, or make it up in coils to put below.

Jam, To, is to fix anything so that it cannot be freed without trouble and force.

Jaw.—The inner, hollowed, semicircular end of a gaff or boom, which presses against the mast; the points of the jaw are called "horns."

Jetsam.—Goods sunk.

Jettison.—Goods thrown overboard.

Jib.—A large triangular sail, set on a stay at the forward end of a jib-boom.

Jib-boom.—A continuation of the bowsprit forward.

Jury-mast.—A temporary or occasional mast erected in a ship in the place of one which has been carried away in a gale.

Kedge.—A small anchor used to warp a ship from one part of a harbour to another.

Keel.—The backbone or foundation of a ship upon which the rest of her structure is built. In wooden ships it consists of squared lengths of suitable timber which are joined at the ends by strong scarphs. In iron ships there are various kinds, bar, side bar, and flat plate keels.

Keelsons are secondary keels fitted internally for the purpose of adding to the longitudinal strength of the ship's bottom.*

Keep your Luff.—An order to the helmsman to keep the ship close to the wind.

Kink.—An accidental curling twist, or doubling turn in a cable or rope.

Knees are pieces of bent iron or steel for connecting certain parts of vessels together, such as the beams or girders to the ribs or frames. In some cases the beams themselves are bent at the ends into knee shapes.

Knight-heads.—The upper parts of the bows immediately each side of the bowsprit.

Lacing.—Small line used for hauling out an awning to the ridge ropes, and also for connecting parts of an awning together.

Lanyard.—A short piece of rope or line made fast to anything to secure it, or to serve as a handle.

Lay, To.—To come or go, as lay aloft, lay forward, lay aft, lay out.

Lay Days.—Days allowed by charter for discharging or loading a cargo.

Lee.—It is the side opposite to that from which the wind is blowing.

Leeway is the distance a vessel loses by drifting to leeward of her course.

Let Fall.—The order to drop a sail loosed from its gaskets in order to set it.

Letter of Credit.—A letter empowering the bearer to obtain money from the party addressed.

Lie-to, To.—To cause a vessel to keep her head steady, and as close to the wind as possible in a gale, so that a heavy sea may not tumble into her. She has perhaps a lower main topsail or tryssails, and comes up to within six points, and falls off to wind abeam, forging rather ahead, but should not be permitted to fall too much to leeward.

* For full description refer to Walton's "Know Your Own Ship," published by Messrs. Charles Griffin and Co., Ltd., in their *Nautical Series*.

Lifts.—Ropes which reach from each masthead to their respective yard-arms to steady and suspend the ends.

List, To.—To incline to one side.

Lizard.—A piece of rope, sometimes with two legs, and one or more iron thimbles spliced into it.

Load Water Line.—The draught of water exhibited when the ship is properly loaded.

Log-book.—Generally called the log, is a journal into which the log-board is daily transcribed, together with any other circumstance deserving notice. The intermediate divisions or watches are usually signed by the commanding officer. It is also divided into harbour-log and sea-log.

Look-out.—The man stationed on the forecastle head or forebridge at night time, or in crowded waters or fog, whenever that may be. He reports everything he sees to the officer on duty.

Lubber's Hole.—The vacant space between the head of a lower mast and the edge of the top.

Luff.—The order to the helmsman to bring the ship's head up more to windward.

Make Fast.—A word generally used for tying or securing ropes. To asten.

Man, To.—To provide a competent number of hands for working a ship or boat.

Manifest.—An official inventory of the cargo of a merchant ship, specifying the name and tonnage of the vessel, the description of goods, the names of shippers and consignees, and the marks of each package.

Mast.—A long cylindrical piece of timber, or iron or steel cylinder elevated perpendicularly upon the keel of a ship, to which are attached the yards, the rigging, and the sails.

Mast Coat.—A conical canvas fitted over the wedges round the mast, to prevent water oozing down from the decks.

Meet Her.—The order to adjust the helm, so as to check any further movement of the ship's head in a given direction.

Metacentre.—In a ship lying perfectly in equilibrium, or upright, a line drawn perpendicular to the keel passes through both the centre of cavity, or buoyancy, and the centre of gravity of the ship. When the ship is heeled to an angle, the centre of buoyancy, owing to the change in the form of the ship immersed, is shifted out of that perpendicular line towards the side to which the ship is heeled in proportion to the angle of heel. A vertical line drawn from this new centre of buoyancy cuts the perpendicular line drawn through the centre of gravity, and the point at which it cuts it is called the **METACENTRE**. The distance between that point, or the metacentre, and the centre of gravity is called the **metacentric height**, and upon the measure of that height depends the leverage, or power of the ship, to right herself when the force which heels her (such as wind) is withdrawn, or to prevent her heeling further if the force is continued. If the centre of buoyancy shifts so much that

the vertical line drawn from it cuts the before-mentioned perpendicular line at or below the centre of gravity the righting power is lost, and the ship will capsize; therefore to be safe the metacentric point must always be above the centre of gravity.*

Midships.—The middle part of the vessel, either with regard to her length or breadth.

Missing Stays.—To fail in going about from one tack to another.

Moorings are indicated by buoys to which ships are fastened; they are attached by bridles to heavy anchors and cables laid down in the most convenient parts of rivers and harbours.

Mould-loft.—A long building, on the floor of which the intended vessel is laid off from the several draughts in full dimensions.

Mousing.—A lashing connecting the bill of a hook with the shank.

Nettles.—Small line used for seizings, and for hammock-clews.

Nip.—A short turn in a rope.

Off and On.—When a ship beating to windward approaches the shore by one board, and recedes from it when on the other.

On End.—Topmasts and topgallant-masts are on end when they are in their places and sail can be set on them.

Open Hawse.—When a vessel rides by two anchors without any cross in her cables.

Painter.—A rope attached to the bows of a boat, used for making her fast; it is spliced with a thimble to a ring-bolt inside the stem.

Partners.—A framework of beams, fitted round the several scuttles or holes in a ship's decks, through which the masts, capstan, &c., pass.

Pauls, or Pawls.—A stout, but short set of bars of iron fixed close to the capstan-whelps, or windlass of a ship, to prevent them from recoiling and overpowering the men.

Pig-Iron.—An oblong mass of cast-iron or lead used for ballast.

Pipe. (See *Call*.)

Piston.—The disc fitted in the cylinders on which the steam from the boiler acts.

Port Charges, or Harbour Dues.—Charges levied on vessels resorting to a port.

Pratique.—The licence to trade and communicate with any place after having performed the required quarantine, or upon the production of a clean bill of health.

Propeller, or Screw.—A spiral blade on a shaft used for propelling the ship.

Protest.—A formal declaration drawn up in writing, and attested before a notary public, a justice of the peace, or a consul in foreign parts,

* See Walton's "Know Your Own Ship" for further explanation of this somewhat difficult but interesting problem.

by the master of a merchant ship, his mate, and a part of the ship's crew, after the expiration of a voyage in which the ship has suffered in her hull, rigging or cargo, to show that such damage did not happen through neglect or misconduct on their part.

Purchase.—Any mechanical power which increases the force applied.

Quarantine.—A seclusion from a free communication with the inhabitants of any country.

Rendering.—Any rope, hawser, or cable is "rendered" by easing it round the bits.

Respondentia.—A loan made upon goods laden in a ship, for which the borrower is personally responsible; differing therein from bottomry, where the ship and tackle are liable. In bottomry the lender runs no risk, though the goods should be lost; and upon "respondentia" the lender must be paid his principal and interest, though the ship perish, provided the goods are safe.

Ride, To.—To ride at anchor.

Ridge-rope.—The centre rope of an awning.

Roach.—The hollow curvature of the lower parts of upper square sails to clear the stays when the yards are braced up.

Run.—The aftermost part of a ship's bottom.

Run out a Warp.—To carry a hawser out from the ship by a boat and fasten it to some distant place to remove the ship towards that place, or to keep her steady whilst her anchors are lifted, &c.

Sagging is the term applied when the centre part of a ship droops.

Scantlings.—The sizes of different parts of a ship, which are determined from certain figures obtained from combinations of the length, breadth and depth of vessels.

Scuppers.—Holes cut in the ship's side to allow the water to run off the decks. The channel-way along the ship's side where the deck joins it.

Scuttle.—A small hole or port cut either in the deck or side of a ship, generally for ventilation.

Serving Board.—A flattened piece of hard wood with a handle, for passing service on the smaller ropes.

Serving Mallet.—The mallet, grooved on the under side, with which spun yarn, or other small stuff, is wrapped tightly round a rope.

Sheer.—The longitudinal curve of a ship's decks or sides upwards towards the ends; a good sheer adds to a vessel's buoyancy, and a certain amount is now insisted upon by the new free-board rules. A perfectly straight ship is said to have "no sheer." Should the ends droop, a ship is said to be out of "sheer."

Ship's Papers.—Documents descriptive of a vessel, her owners, cargo, destination and other particulars necessary for the court of instance.

Ship-shape.—Everything clean and in its proper place.

Shore.—A prop put under a ship's deck to distribute the strain caused by the foot of a derrick or sheers.

Sill of a Dock.—The timber at the base against which the gates shut; the depth of water which will float a vessel in or out of it is measured from it to the surface.

Skids.—Spars or beams placed across the ship in which the boats are stowed in chocks.

Slack in Stays.—Slow in going about.

Slip.—The difference between the speed of a vessel and the speed of the propeller.

Sounding.—The operation of ascertaining the depth of the sea and the quality of the ground by means of a lead and line.

Span.—A rope with both ends made fast, so that a purchase may be hooked to its bight.

Spell.—The period wherein one or more sailors are employed in particular duties demanding continuous exertion.

Spring.—A hawser laid out to some fixed object to slue a vessel proceeding to sea.

Spurlingate.—The opening in the deck through which the chain cable goes.

Start.—To start, applied to liquids, is to empty. To "start a tack or sheet": to slack it off, as in tacking or manœuvring. "Raise tacks and sheets."

Staysail.—A triangular sail hoisted upon a stay.

Stem.—The foremost piece uniting the bows of a ship.

Step.—The block in which the heel of a lower mast rests.

Stern Board.—This term is familiarly known to seamen as tacking by misadventure in stays, or purposely, as a seaman-like measure, to effect the object. Thus a ship in a narrow channel is allowed to fly up head to wind until her stem nearly touches a weather danger; the head yards are then quickly braced abox and the helm shifted. Thus she makes sternway until all the sails are full, when she is again skilfully brought to the wind before touching the danger under her lee. Generally speaking, however, it refers to bad seamanship.

Stowage.—An important art more practised than understood, for the stower seldom consults the specialities of the vessel's construction. It is the general disposition of the ballast, cargo, &c., contained in a ship's hold with regard to their shape, size or solidity, agreeably to the form of the vessel and its probable centre of gravity. A badly stowed vessel cannot be properly handled, and is indeed dangerous to the lives of all on board. Owners and masters are legally liable for the losses from bad stowage or deficient dunnage.

Stranded.—A rope is stranded when one of its strands is broken by chafing, or by a strain. A vessel is stranded when driven on shore.

Stream the Buoy.—To let the buoy fall into the water before letting go the anchor.

Stringers.—Longitudinal stiffeners above the bilge keels.

Swab.—A sort of long mop, formed of rope-yarns of old junk, used for cleaning and drying the decks.

Swig Off, To.—To pull at the bight of a rope by jerks, having its lower end fast.

Sword Mat.—A mat made with shoulders to protect the lanyards of the lower rigging, boat's gripes, &c., and worked by a piece of wood somewhat resembling a sword in shape, to drive home the roving threads.

Tail Block.—A rope-stopped block, having an end of rope attached to it as a tail, by which it may be fastened to any object at pleasure.

Tare.—Deduction for weight of the material holding the goods.

Tarpaulin.—Canvas well covered with tar or paint to render it water-proof.

Tender.—A synonym of crank, as applied to a ship.

Thole Pin.—Pins in the gunwale of a boat, and serving to retain the oars in position when pulling.

Throttle Valve.—A valve in the steam-pipe of an engine for preventing the escape of steam, or regulating the velocity of its passage from the boiler to the cylinder.

Thrust-block.—A heavy piece of metal fitted with grooves, between which rings on the propeller-shaft work, thereby transmitting motion to the ship.

Tonnage.—The cubical contents of a vessel allowing 100 cubic feet to the ton. The continental equivalent is 2.8316 cubic metres.

Gross Tonnage is the total cubic capacity of every enclosed space on board ship.

Net Tonnage is that space available for cargo only.

Register Tonnage is that measured and entered on the ship's register; it is practically the same as net tonnage.

Torts.—Private wrongs either to persons or property afloat. They are cognisable by the Admiralty Court, according to locality.

Tow.—To draw or drag a vessel along by means of a rope or hawser.

Transome Plate.—A deep plate fitted against the upper part of the stern post to strengthen the stern.

Trim.—The difference between the draughts at the stern and bow.

Trucks.—Circular caps on the upper mastheads; they are generally furnished with two or more small sheaves, through which the signal halliards are rove.

Tumble Home.—The difference amidships between the beam of the upper deck and the extreme beam.

Under Foot.—Under the ship's bottom; said of an anchor which is dropped while she has headway.

Under Way.—When a vessel is moving through the water.

Under Weigh, To get.—Preparing to get under way by loosing the sails and getting up steam and weighing the anchor.

Unrig, To.—To dismantle a ship of her standing and running rigging.

Up with the Helm.—Put it a-weather.

Uvrou.—The circular piece of wood, with holes in it, by which the legs of a crow-foot are extended for suspending an awning.

Vacuum.—Emptiness produced in the condenser by means of the air pump.

Vane.—A metal rod fixed to the top of the truck on the mast-head to carry a small wind vane or light pennant. To this rod can also be fixed the lightning conductor.

Veer, To.—To let out, to pay out.

Veer and Haul.—To gently tauten and then slacken a rope three times before giving a heavy pull, the object being to concentrate the force of several men. The wind is said to veer and haul when it alters its direction; thus it is said to veer aft and haul forward.

Veer away the Cable, To.—To slack and let it run out.

Ventilator.—The names of various machines contrived to expel the foul air from below decks, and introduce fresh in its stead.

Wake.—The transient, generally smooth, track impressed on the surface-water by a ship's progress.

Water-logged.—The state of a ship full of water, having such a buoyant cargo that she does not sink.

Water-ways.—The strake on the inside of a vessel in line with the edge of the upper deck, forming a gutter-way to lead the water off the deck to the scuppers.

Weather, To.—That is, to pass on the windward side.

Weather-helm.—A ship is said to carry a weather-helm when she is inclined to gripe, or come too near the wind, and therefore requires the helm to be kept constantly a little to windward.

Well is the part of the vessel where any water that leaks into the ship can collect, and from thence it is pumped overboard.

Windlass.—A machine erected in the fore-part of a ship which serves to ride by, as well as heave in the cable.

Yard.—A long cylindrical timber or iron or steel cylinder suspended upon the mast of a vessel to spread a sail.

Yard-arm.—That part of a yard outside the quarter.

ABBREVIATED TERMS.

- P. P. I. = policy proof of interest.
- F. A. A. = free of all average.
- C. I. F. = cost, insurance and freight (all these charges are included in the price quoted).
- F. O. B. = free on board.
- F. C. and S. = free of capture and seizure.

WEATHER FORECASTING.

The ability to accurately forecast weather ought to be instinctive in sailors, and undoubtedly would be if they cultivated a habit of close observation of natural phenomena as a very necessary part of their calling. They have every opportunity of growing familiar with the varying aspects of sky and clouds, and he is an unobservant seaman who does not learn quickly their meaning and portent. The man who easily grasps the significance of natural signs and who attends to his barometer and sky signs is never taken unawares, even in regions where violent storms occur with peculiar suddenness.

In all hurricane areas there is a daily regular oscillation of the barometer ; it is low about 4 A.M., gradually rises until 9 A.M., then falls by degrees until 4 P.M., when it again rises until 9 P.M., and then falls as before to 4 A.M. This is the ordinary daily barometric routine in hurricane areas ; and any deviation from this normal course should be immediately noticed by the observer. For instance, should a fall instead of a rise be registered about 9 A.M., some atmospheric disturbance is the cause and its nature should be looked for in the general meteorological conditions of the sky.

There are, roughly speaking, two types of clouds ; the Cumulus or Heap type (Fig. 51a) and the Stratus or Layer type (Fig. 56). Cumulus, as the name indicates, are large globular heaps of clouds : Stratus are layer-like formations of clouds, the under and upper surfaces of which are more or less parallel, though varying a good deal in thickness.

The cloud known as the cirrus (Fig. 58) or curl cloud is a variety of stratus and is the most significant of all clouds in weather forecasting. It floats in the highest regions of the atmosphere, is white and often feathery looking, or it may appear in fine lines across the sky or as a thin white veil, through which the sun shines surrounded by a ring called a halo (Fig. 60).

The appearance of cirrus clouds is, as a rule, the first indication of a change of weather. When cirrus is present in the sky in feathery flecks or short streaks it is of no importance ; but directly it appears in continuous streaks either parallel to the horizon or up from the horizon like the spokes of a wheel it should be carefully watched as an indicator of bad weather to come, more particularly if it be noticed in the storm areas of the globe, or at periods of the year



FIG. 51a.—CUMULUS (FINE WEATHER VARIETY).



FIG. 53.—CUMULUS (SQUALL VARIETY WITH WATERSPOUTS).



FIG. 52.—CUMULUS (SHOWER VARIETY).



FIG. 54.—STRATUS AND CUMULUS (HURRICANE APPROACHING).



FIG. 55.—STRATUS (FOG VARIETY)



FIG. 56.—STRATUS (FINE WEATHER VARIETY).



FIG. 57.—STRATUS (CIRRO-CUMULUS OR MACKEREL SKY VARIETY).



FIG. 58.—VERY HIGH STRATUS (CIRBUS VARIETY TAKING THE V OR RADIANT POINT SHAPE) INDICATING APPROACH OF STORM.



FIG. 59.—STRATUS (NIMBUS VARIETY) RAIN FALLING.

when storms of extra violence may be looked for. Fig. 58 shows the warning cirrus cloud shooting up from the horizon in the form of wheel-spokes; a very severe gale followed quickly after its appearance. In the hurricane areas, cirrus clouds are more striking and more characteristic than elsewhere and so more easily attract attention.



FIG. 60.—HALO.

The storm areas of the globe may be roughly defined as follows:

(1) The belt of storms N. of the 35° parallel of N. latitude and that one South of the 30° parallel of S. latitude, in both of which storms are frequent, but only occasionally of phenomenal violence.

(2) The hurricane (as storms of extreme and concentrated violence are called) districts: the West Indies, Bay of Bengal, China Seas, Mauritius, Samoa.

(3) The smaller hurricane or tornado districts, as that off the West coast of Africa.

Cyclones or hurricanes are generally preceded by a peculiar stillness and sultriness in the atmosphere and the appearance of cirrus clouds. Then follow the falling of the barometer and, sometimes, a "ground" swell. When such symptoms are noticed it

is well, even in port, to prepare for a storm, the magnitude, &c., of the preparation being guided by the experience of those familiar with the district.

Violent hurricanes occur in the regions of the great monsoonal changes, and tornadoes in the districts where the monsoonal changes are less marked.

A swell coming up in an opposite direction to that of the wind constantly precedes a change of wind in high latitudes, where indeed the observer has usually ample warning of approaching weather.

But as the storm centre passes over him, the changes in the direction of the wind are apt to be sudden and unforeseen so that a ship may be taken unawares and suffer loss of masts, &c. Only experience will teach the observer when to expect and how to deal with suddenly shifting winds.

Unusual and lurid sky colours at sunrise and sunset ; remarkable trembling or scintillation of stars at night time ; mock suns ; St. Elmo's fires on mastheads and yard-arms ; a number of layers of clouds accompanied by rapid movement ; are all more or less weather warnings which should be noted in conjunction with the movement of the barometer.

There are many good text-books * on meteorology and sailors will do well to study carefully one or more of them, so that they may not be caught unawares in a storm for which a previous knowledge of meteorological laws and portents would have found them prepared.

* For instance, that on Meteorology in this series ; also the Barometer Manual published by the Meteorological Office.

QUESTIONS

ON

CAPTAIN WILSON-BARKER'S "SEAMANSHIP"

: (Blanks left for future questions.)

PART I.

BUILDING OF A SHIP.

	PAGE
1. What is the general structure of the body of a vessel called ?	1
2. What does it consist of ?	1
3. What is the foundation of the ship ?	1
4. What is necessary for the proper learning of the parts of the ship ?	1
5. What is the first thing a naval architect does when the order for a ship comes in ?	1
6. What does he consider when preparing plans ?	1
7. What is done with the plans when they are prepared ?	1
8. What is the "scribe-board" ?	1
9. How are the frames and girders prepared ?	1
10. How is the ground prepared on which to build the vessel ?	1
11. What are ribbands ?	2
12. What is the general order of building the ship ?	2
13. What is the "launching-way" ?	2
14.	2
15.	2
16.	2
17.	2
18.	2
19.	2
20.	2

DESCRIPTION OF PARTS OF HULL

21. Where is the water-ballast carried in a vessel ?	2
22. What are water-tight doors ?	2
23. What is a bulkhead ?	2
24. What is a sluice-valve ?	3
25.	3

FITTING ALOFT.

	PAGE
26. What are the names of the spars of a four-masted ship ? .	3
27. What are the names of the sails of a four-masted ship ? .	3
28. Special questions on plate of sailing-ship	3
29.	3

RIGGING.

30. What is the name of the rigging of a four-masted ship ? .	4
31. General questions on rigging	4
32.	4
33.	4
34.	4

RIGS.

35. What are the classes of rig in sailing vessels ?	4
36. What advantage has a "fore-and-aft rig" over a square-rigged vessel ?	4
37. How are the rigs of steamers distinguished ?	4
38. How close to the wind can a fore-and-aft vessel sail ? . . .	4
39. How close to the wind can a square-rigged vessel sail ? . . .	4

GOING ALOFT.

40. Which side do you go up aloft, and why ?	4
41. What do you take hold of in going aloft ?	5
42. What is the "catch ratline" ?	5
43.	5
44.	5
45.	5

BOATING.

46. What are boats built of ?	5
47. What are the ways of building boats ?	5
48. What are the boats generally carried by sea-going vessels ? .	5
49. What is the peculiarity of a life-boat ?	5
50. How are boats to be fitted for sea ?	5
51. How are the hands to be placed in pulling ?	5
52. What is the proper stroke to pull in a sea-boat ?	5
53. What precaution should you take in feathering in a sea-boat ?	5
54. What is "catching a crab" ?	5
55. How should the oar be held ?	5
56. What is the general position in pulling through a stroke ? .	5
57. What is a common fault in learning to row ?	7

	PAGE
58. What should an officer do when told to take away a boat at sea ?	7
59. How would you take out a rope for mooring or warping purposes ?	7
60. How are boats stowed for sea ?	7
61. What is "sculling" ?	7
62. How would you tow a boat alongside ?	8
63.	

THE MARINER'S COMPASS.

64. What is the mariner's compass ?	8
65. What is the mariner's compass used for ?	8
66. Describe the compass	8
67. How is the compass divided up ?	10
68. Name the points of the compass	10
69. How are the degrees marked upon a compass ?	10
70. What is the "lubber's line" ?	10
71. What is the "lubber's line" for ?	10
72. What is the Azimuth Vane ?	10
73. What is a clinometer ?	10
74. What are the quadrantal correctors ?	11
75. What is the Flinder's bar ?	11
76. How is the compass corrected for deviation ?	11
77.	11
78.	11
79.	11

MARLINE-SPIKE.

80. What is a marline-spike ?	11
81. What precaution do you take in carrying a marline-spike aloft ?	11
82. What precaution do you take in carrying anything aloft ?	11
83.	11
84.	11
85.	11

BELAYING-PINS AND CLEATS.

86. What is a belaying-pin ?	12
87. What is the cleat ?	12
88. Illustrate the right and wrong way of belaying a rope	12
89. What is it never advisable to do with regard to making a rope fast ?	12
90. What are fife-rails ?	12
91.	12
92.	12
93.	12
94.	12

WATCHES AND TIME.

	PAGE
95. What are the "watches" on board ship ?	12
96. What are the "dog watches" ?	12
97. How is the time made known on board a ship ?	13
98. Make a list of the hours and half-hours and the bells struck to distinguish them	13
99. How are the bells struck ?	13
100. What is an "anchor" watch ?	13
101.	13
102.	13
103.	13
104.	13

PART II.

ROPES.

105. What are ropes made of ?	15
106. Name the vegetable fibres used in rope-making	15
107. How are fibres made into ropes ?	15
108. What is a hawser-laid rope ?	15
109. What is the peculiarity of a four-stranded rope ?	15
110. What is a cable-laid rope ?	15
111. What is a coir rope ?	15
112. What valuable property does a coir rope possess ?	15
113. How many strands are there in a wire rope ?	15
114. What is the use of a hemp heart in a wire rope ?	15
115. How are ropes measured ?	15
116. What length are ropes made up in ?	15
117. What are ropes dressed with before using ?	15
118. What is ratline stuff ?	15
119. What is amberline ?	15
120. What is codline ?	15
121. What is marline ?	15
122. What is spun-yarn, and how many kinds are there ?	15
123. What is a warp ?	16
124. What is a hawser ?	16
125. What are hawsers and warps used for ?	16
126. And what kind of hawsers are generally used ?	16
127. How do you coil a rope for running ?	16
128. How would you open a new coil of rope ?	16
129.	16

KNOTS.

130. What is a "knot" ?	16
131. Questions on knots	16

	PAGE
132. What are bends and hitches ?	16
133. What is a clove hitch used for ?	16
134. What is a round turn and two half-hitches used for ?	16
135. What is a timber hitch, and what is it used for ?	16
136. What is a rolling hitch, and what is its use ?	16
137. What is a marline-spike hitch, and what is it used for ?	20
138. What is a blackwall-hitch, and what is it used for ?	20
139. What is a marline hitch, and what is it used for ?	20
140. What is a sheet bend, and what is it used for ?	20
141. What is a cat's-paw, and what is it used for ?	20
142. What is a stopper ?	20
143. How do you pass a stopper ?	20
144. What is the use of a stopper ?	20
145. How many kinds of clinches are there ?	20
146. What are clinches used for ?	20
147. What is a selvagee strop ?	20
148. What is a selvagee strop used for ?	20
149. What is a bowline ?	20
150. What is a bowline used for ?	20
151. What is a bowline on the bight ?	20
152. What is it used for ?	20
153. What is a running bowline ?	20
154. What is a running bowline used for ?	20
155. What is a sheepshank used for ?	20
156. What is a sling ?	20
157. Describe how a sling is used	20
158. How can you make a makeshift sling ?	20
159. What is a parbuckle ?	20
160. What is a parbuckle used for ?	20
161. How would you sling a cask on end ?	22
162. How would you sling casks ?	22
163. What are can hooks ?	22
164.	22
165.	22
166.	22
167.	22
168.	22
169.	22

SPLICING.

170. What is splicing ?	23
171. Name the different kinds of splices	23
172. What is the general principle of a splice ?	23
173. What is the advantage of a long splice ?	23
174. What peculiarity is there in any splicing a cable-laid rope ?	23
175. What should you be careful of in making a splice ?	23
176. What particular care must you take in long-splicing a wire rope ?	23
177. What does the neatness of a wire splice depend a great deal on ?	27
178. Give some particulars of the various makes of wire ropes	31

	PAGE
179.	31
180.	31
181.	31
182.	31
183.	31
184.	31

NETTING.

185. What kinds of nets are there ?	34
186. How are nets made ?	34
187. Where are nets generally fitted in a sea-going ship ?	34
188.	34
189.	34

SENNIT.

190. What is sennit ?	35
191. What are the different kinds of sennit ?	35
192. What is sennit chiefly used for ?	35
193.	35
194.	35

TO WORM, PARCEL, AND SERVE.

195. How do you "worm" a rope ?	35
196. What is the idea of "worming" the rope ?	35
197. How do you parcel a rope ?	35
198. How do you serve a rope ?	36
199. What is "service" chiefly used for ?	36
200. What is the "rhyme" about worming and parcelling a rope ?	37
201.	37
202.	37
203.	37
204.	37

MASTS AND RIGGING

205. What are masts made of ?	37
206. How are masts secured in a ship ?	37
207. What are trestle-trees ?	37
208. What are the hounds ?	37
209. What are the cheeks ?	38
210. What are the cross-trees ?	38
211. What is the use of the trestle-trees ?	38
212. What are the cross-trees used for ?	38
213. What is the top ?	38
214. In what order is the lower rigging put on ?	38
215. What are cap shrouds ?	38

	PAGE
216. What is a cap backstay ?	38
217. What is the use of cap shrouds and cap backstays ?	38
218. How are topmasts secured ?	38
219. What are cross-tree outriggers ?	38
220. What are cross-tree outriggers for ?	38
221. Where does the lower rigging set up ?	38
222. By what means is the lower rigging set up ?	38
223. How are stays set up ?	38
224. What is the order of setting up all the rigging ?	38
225. What is a swifter ?	38
226.	38
227.	38
228.	38
229.	38
230.	38
231.	38
232.	38
233.	38
234.	38

BOWSPRIT, ETC.

235. What is a bowsprit ?	38
236. How is the bowsprit fitted in the modern ships ?	38
237. What holds the bowsprit in its position ?	38
238. What is the bowsprit intended for ?	38
239. Where are the forestays set up ?	38
240. Where are the foretop-mast stays set up ?	38
241. Where does the foretop-mast stays'l stay set up ?	38
242. Where do the jib stays set up ?	38
243. Where do the t'gallant and royal stays set up ?	38
244. What are lower masts, topmasts and bowsprits generally made of ?	38
245.	38
246.	38
247.	38
248.	38
249.	38

FITTINGS OF YARDS AND GAFFS.

250. What are yards ?	38
251. How are lower yards fitted ?	38
252. Why are two jackstays sometimes fitted on yards ?	39
253. How are the foot-ropes secured ?	39
254. What are stirrups ?	39
255. What are foot-ropes generally made of ?	39
256. What are brace pendants and lifts made of ?	39
257. What are slings and truss made of ?	39
258. How are lower lifts fitted ?	39
259. How are the lower topsail and lower t'gallant yards fitted ?	39

	PAGE
260. What is a yard crane ?	39
261. What is a tub or parrel ?	39
262. What is a tub or parrel for ?	39
263. What are the halliards ?	39
264. What are braces ?	39
265. How are braces fitted ?	39
266. What are gaffs ?	39
267. How are gaffs generally fitted ? Describe both ways	39
268. How is the sail attached to a gaff ?	39
269. What is a spanker boom ?	40
270. How is a spanker boom fitted ?	40
271. What are vangs ?	40
272.	40
273.	40
274.	40
275.	40
276.	40
277.	40
278.	40
279.	40

WHIPPINGS.

280. How do you make an ordinary whipping ?	40
281. How do you make a sailmaker's whipping ?	40
282. What is the advantage of a sailmaker's whipping ?	40
283. What is a West-country whipping ?	40
284. What is a West-country whipping useful for ?	40
285. What is a whipping for ?	40
286.	40
287.	40
288.	40
289.	40

PART III.

RUNNING GEAR.

290. Running gear (general questions)	41
291. What is running gear ?	41
292. Why is it called "running gear" ?	41
293. What is the principal running gear ?	41
294. What are buntlines ?	41
295. What are spilling lines ?	41
296. What is the great value of buntlines and spilling lines ?	41
297. What are leechlines ?	41
298. What is a slabline, and what is it used for ?	41

	PAGE
299. What are clew garnets and clewlines, and what is the distinction between them ?	41
300. How are the courses set ?	41
301. How are sheets and tacks fitted to a course ?	41
302. How is a tack boarded ?	42
303. What is a lazy tack ?	42
304. Questions on a square sail	42
305. Draw a plan of a square sail and name the different parts	43
306. Give the names of the gear on the mains'l	43
307. How is the gear fitted on the mains'l ?	43
308. How are the sails above the courses set ?	42
309. What are bowlines, and what are they for ?	43
310. What difference is there in the fittings of the clews of an upper t'gallant sail, and an upper topsail, and the other square sails ?	43
311. Where are clewlines and buntlines of a topsail led ?	43
312. Where are clewlines and buntlines of t'gallants'ls and royals led ?	43
313. What are reef-tackles ?	43
314. How are reef-tackles fitted ?	43
315. How are fore-and-aft sails, such as try sails, spankers and drivers, set ?	43
316. What are brails ?	43
317. How are brails fitted ?	43
318. Why are stays'ls sometimes fitted with tripping lines ?	43
319. Why are jibs and head-stays'ls fitted with double sheets ?	43
320. How are staysail and jib sheets fitted ?	43
321. How are other fore-and-aft sails fitted ?	43
322. What do you do with the running gear of a sail when it is set, and why ?	43
323. What should you do with the gaskets, and why ?	43
324. What is the general object of running gear in a sail ?	43
325. How could you often give assistance in taking in a sail ?	43
326. Draw a fore-and-aft sail, and name the different parts	44
327.	44
328.	44
329.	44
330.	44
331.	44
332.	44
333.	44
334.	44
335.	44
336.	44
337.	44
338.	44
339.	44

SEIZINGS.

340. What are seizings ?	45
341. What are the principal seizings ?	46

	PAGE
342. What is a racking seizing used for ?	46
343. Is there any difference between the name of a hemp or wire seizing ?	46
344. Questions on seizings	46
345.	46
346.	46
347.	46
348.	46
349.	46

LEAD AND LOG-SHIP.

350. What is the lead ?	46
351. What is a log-ship ?	46
352. What are lead-lines made of ?	46
353. How are lead-lines measured ?	46
354. What precaution do you take in marking and measuring the lead-line ?	46
355. What are the deeps on the lead-line ?	46
356. What are the marks on the lead-line ?	46
357. How do you distinguish the marks on the lead-line at night ?	47
358. What is the length of the hand lead-line ?	47
359. What is the weight of a hand lead ?	47
360. How to ascertain the nature of the bottom by means of the lead	47
361. How is the lead fitted for attaching to the line ?	47
362. What is the weight of a deep-sea lead ?	47
363. What is the length of a deep-sea lead-line ?	47
364. How is the deep-sea lead-line marked ?	47
365. What is the leadsman ?	47
366. How do you heave the lead ?	47
367. How do you announce the soundings ?	47
368. What are patent sounding machines ?	47
369. What kind of "line" is generally used with patent sounding machine ?	47
370. Is there any way by which you can read off the sounding before heaving in the lead ?	48
371. What other purpose can the modern sounding gear be put to ?	48
372. How is the log-ship fitted ?	49
373. What is the idea of the log-ship ?	49
374. How is the log-line fitted ?	49
375. What is the idea of the stray line ?	49
376. If the ship's rate exceeds 5 knots, what kind of second-glass is used ?	50
377. What precaution should you take before marking a log-line ?	50
378. What are patent logs ?	50
379.	50
380.	50
381.	50
382.	50
383.	50

	PAGE
384.	51
385.	51
386.	51
387.	51
388.	51
389.	51
390.	51
391.	51
392.	51
393.	51
394.	51

SPANISH WINDLASS.

395. What is a Spanish windlass ?	51
396. What is a Spanish windlass used for ?	51
397. How do you make and use a Spanish windlass ?	51
398.	51
399.	51

BLOCKS.

400. What is the block ?	51
401. How are blocks fitted for use ?	51
402. How do you strop a block ?	52
403. How do you measure the length of a rope for stropping a block ?	52
404. In putting the thimble in, what precaution do you take ?	52
405. How are strops often treated before putting them round the block ?	52
406. How do you make a grommet strop ?	52
407. What kinds of blocks are generally used now ?	52
408.	52
409.	52
410.	52
411.	52
412.	52
413.	52
414.	52

TACKLES AND PURCHASES.

415. What are tackles and purchases ?	52
416. What are the different parts of a purchase ?	52
417. What is the general principle of a purchase ?	52
418. How would you ascertain the purchase required to lift a heavy weight ?	52
419. What is a Spanish burton ?	53
420. What is a luff tackle ?	53

	PAGE
421. What is a runner and tackle ?	53
422. What is a handy billy ?	53
423. What is a single whip ?	53
424.	53
425.	53
426.	53
427.	53
428.	53
429.	53

PART IV.

A.—RIGGING.

430. What is it necessary to know to be able to cut out shrouds ?	55
431. What precaution do you take in cutting out shrouds ?	55
432. How do you fit the shrouds ?	55
433. After fitting a pair of shrouds, what precaution do you take ?	55
434. How do you lengthen or shorten a shroud after it is made ?	55
435. In setting up shrouds with dead-eyes, where does the knot or splice of a lanyard come ?	55
436. How are stays fitted ?	55
437. What precaution do you take to prevent chafe on the sails from the stays ?	55
438. Where do stays set up ?	55
439. How are foremast-shrouds fitted to prevent chafe of sails ?	56
440. How is rigging fitted in a steamer ?	56
441.	56
442.	56
443.	56
444.	56

SETTING UP RIGGING.

445. In setting up the lower rigging, what do you set up first ?	56
446. In what order do you set up the shrouds ?	56
447. What is a very good guide to getting the mast upright ?	56
448. How do you set up lower rigging ?	56
449. How is the t'gallant rigging set up ?	57
450. How is the topmast rigging set up ?	57
451. How do you set up rigging with screws ?	57
452.	57
453.	57
454.	57

RATTLING DOWN.

455. How do you rattle down rigging ?	59
---	----

	PAGE
456. What is the usual space allowed between the ratlines ?	59
457. What is a catch ratline ?	60
458. What is tarring down ?	60
459.	60

ANCHORS AND CABLES.

460. What is an anchor ?	60
461. What is a cable ?	60
462. In what length are chain cables generally made up ?	60
463. How are chains led and attached to the anchor ?	60
464. Where is the chain cable stowed ?	60
465. Where is the end of the chain cable fastened ?	61
466. Are any precautions generally taken to insure anchors and cables being kept in good order ?	61
467. Describe the different forms of anchors now generally used	61
468. Name the parts of an anchor	61
469. What anchors are generally carried on board ship ?	61
470. What is a stream anchor ?	61
471. What is a bower anchor ?	61
472. What is a kedge anchor ?	61
473. What is a stream chain ?	61
474. Which way are shackles put on the chain, and why ?	61
475. How are the pins of anchor and cable shackle fitted ?	62
476. How are the shackles fitted to the anchors ?	62
477. How are anchors secured ?	62
478. How are anchors let go ?	62
479. In getting an anchor up the ship's side, what precaution do you take ?	62
480. What should the officer do while heaving up the anchor ?	62
481. Why should the captain be informed every now and then when heaving in or paying out ?	62
482. What is a foul anchor ?	62
483. What should be done with a foul anchor ?	62
484. What precaution should you take when heaving in the cable with regard to the shackles ?	62
485. How do you mark off lengths of chain cable ?	63
486. What is the object of marking the cable ?	63
487. When is a good opportunity for overhauling chain cables ?	63
488. What are anchor buoys ?	63
489. How are anchor buoys fitted ?	63
490. What is the object of having the anchor buoyed ?	63
491.	63
492.	63
493.	63
494.	63
495.	63
496.	63
497.	63
498.	63
499.	63

ANCHORING A STEAMER.

	PAGE
500. What should you do before coming to an anchorage ? . . .	64
501. What is the best position for having the ship in for letting go the anchor ? . . .	64
502. In anchoring a ship, what have you always to consider very carefully ? . . .	64
503. In anchoring a vessel, what cable would you pay out ? . . .	64
504.	64
505.	64
506.	64
507.	64
508.	64
509.	64

ANCHORING A SAILING SHIP.

510. How would you bring a sailing ship to an anchor with wind off the shore ? . . .	64
511. How would you bring a sailing ship to an anchor with the wind aft ? . . .	64
512. What precaution should you take when anchoring with a single anchor ? . . .	64
513.	64
514.	64
515.	64
516.	64
517.	64
518.	64
519.	64

GETTING UNDER WEIGH IN A SAILING VESSEL.

520. How would you get under weigh in a sailing vessel with the wind off the land ? . . .	64
521.	64
522.	64
523.	64
524.	64

MOORING.

525. How do you moor a ship ?	65
526. How do you unmoor a ship ?	65
527. What is a foul hawse ?	65
528. How would you clear a foul hawse ?	65
529. What is a mooring shackle ?	66
530. What is the use of a mooring shackle ?	66
531. What precautions do you take in removing a mooring shackle ?	66

	PAGE
532. How should a mooring shackle be placed on the cables ?	66
533. How can you distinguish the different cables when unmooring?	66
534. Mooring or making fast to a wharf or pier ?	68
535.	68
536.	68
537.	68
538. What is a heaving line ?	68
539. How do you take out a guess-warp ?	68

LAYING OUT AN ANCHOR.

540. What is the general object of laying out an anchor ?	66
541. What is the best kind of boat to lay out an anchor from the ship ?	66
542. How many methods are there for carrying out a small anchor ?	66
543. Describe an easy way of laying out an anchor	67
544. What precautions do you take in laying an anchor out ?	67
545. How is the boat to be steered when you are laying an anchor out ?	67
546. Should buoys always be fitted when laying an anchor out ?	67
547.	67
548.	67
549.	67

TENDING A SHIP IN A TIDEWAY.

550.	68
551.	68
552. Why is it necessary to tend a ship in a tideway ?	68
553.	68
554.	68

SENDING YARDS UP AND DOWN.

555. How do you send royal and t'gallant yards up and down ?	69
556. What are royal and t'gallant yards generally sent down for ?	69
557. Describe the operation of sending down a royal or t'gallant yard	69
558. What kind of halliards are fitted to t'gallant yards ?	69
559. Describe the operation of sending up a topsail yard	69
560. How are halliards to upper topsail yards fitted ?	69
561. General questions on sending yards up and down	69
562.	69
563.	69
564.	69

B.—SAILMAKING.

565. Why should the young officer understand the principle of sail-making ?	71
---	----

	PAGE
566. How many suits of sails are generally carried now ?	71
567. When are the different suits of sails bent ?	71
568. Name the tools generally used in sail-making	71
569. What is the canvas or sailcloth made of ?	71
570. How is the canvas made up ?	71
571. What is the average length of canvas in a "bolt" ?	72
572. What is the width of canvas ?	72
573. What are the names of the threads in canvas ?	72
574. What are selvages ?	72
575. How should you cut canvas ?	72
576. What is a gore ?	72
577. Why should you cut a gore carefully ?	72
578. Name the different kinds of canvas	72
579. What is tarpaulin canvas ?	72
580. What is a test for good canvas ?	72
581. What are boat-sails generally made of ?	72
582. What is twine ?	72
583. Describe the different kinds of twine	72
584. What do you do with the twine before using it ?	72
585. What is roping twine used for ?	72
586. Where is the fore course gored ?	72
587. Where are jibs gored ?	72
588. What is tabling ?	72
589. What width do you take for tabling ?	72
590. What are lining cloths ?	72
591. What are lining cloths for ?	72
592. How many kinds of seams are there ?	73
593. Has any seam an advantage over the other ?	73
584. How do you join two pieces of canvas together ?	73
595. Questions on the seams	73
596. What is middle-stitching ?	74
597. When is a middle-stitch used ?	74
598. What should be done with sails before placing below and before bending ?	74
599. What precaution do you take in stowing away sails in the sail-room ?	74
600. What is a herring-bone stitch ?	74
601. What is a herring-bone stitch used for ?	74
602. What is "roping" ?	74
603. What precaution do you take in putting the rope on the sail ?	75
604. How should you treat wire rope when it is used for roping a sail ?	75
605. What are cringles ?	75
606. What are cringles for ?	75
607. What are cringles made of ?	75
608.	75
609.	

C.—BENDING AND UNBENDING SAILS.

610. What aim do you specially wish to attain in bending sails ?	77
611. How should a sail be made up for bending ?	77

	PAGE
612. What parts of the sails should be easy of access ?	77
613. Do you take any precaution on account of the weather ?	77
614. By what special means can you steady a sail when sending it aloft ?	77
615. How should a sail rope be rove ?	77
616. How do you heave the sail up ?	77
617. How should you ensure the sail going up clear ?	77
618. What are sails bent to the jackstays with ?	77
619. What are "rovings" ?	77
620. How should the sail rope be bent on to a sail ?	77
621. How do you bend a course ?	77
622. Do you always bend a sail in the same way ?	78
623. What are earings ?	78
624. How are earings passed ?	78
625.	
626.	
627.	
628.	
629.	

BENDING ON JIB.

630. How do you bend a jib ?	79
631. How do you unbend a jib ?	79
632. How is a staysail bent ?	79
633.	
634.	

BENDING A SPANKER.

635. How do you bend a spanker or driver ?	79
636.	79
637.	
638.	
639.	

SETTING SAIL.

640. What do you aim at chiefly in setting sail ?	79
641. What sails are generally set first ?	79
642. How do you set a topsail ?	79
643. What should the hands aloft do after a sail is set ?	79
644. How do you tend the braces, when hoisting a yard ?	79
645. What ropes are let go in hoisting a yard ?	79
646. Where should the lifts of upper yards be placed when the sail is set ?	79
647. How do you loose a single t'gallants'l or royal ?	79
648. How do you set a single t'gallants'l or royal ?	79
649. How do you set a jib or topsail ?	80
650. How do you set a driver or spanker ?	80

	PAGE
651. How do you set a course ?	80
652.	
653.	
654.	

TAKING IN SAIL.

655. How do you take in a single t'gallants'l or a royal ?	80
656. In taking in a sail, why do you wish to spill the sail ? . . .	80
657. How do you take in a lower topsail ?	80
658. How do you haul up a mainsail ?	80
659. How do you furl a square sail ?	80
660. Why do you endeavour to form a skin of one part of the sail over another ?	80
661. How do you pass a gasket ?	80
662. What is bunt whip ?	81
663. How do you take in a jib or stays'l ?	81
664. How could you give assistance in taking in one of the head sails ?	81
665. How do you take in a driver or spanker ?	81
666. Why do you first haul up the lee brails in taking in a driver or spanker ?	81
667.	81
668.	
669.	

TRIMMING SAIL.

670. What is trimming sail ?	81
671. Why should an officer pay particular attention to the trim- ming of a sail ?	81
672. Explain the principle upon which sails act	81
673. What is the "true" direction of the wind ?	81
674. What is the "apparent" direction of the wind ?	83
675. Why is there a difference between the "true" and "appa- rent" direction of the wind ?	83
676. Is any difference made in trimming yards in strong and light winds ?	81
677. Is there any difference between bracing lower and upper yards ?	83
678. What great advantage has a double topsail over a single top- sail in sailing on a wind ?	83
679. What is necessary to do with regard to the ropes when the weather is wet ?	84
680.	
681.	
682.	
683.	
684.	

BRACING UP AND SQUARING IN.

	PAGE
685. Is it always advisable to sail a vessel as close to the wind as possible when beating to windward ?	84
686. In "bracing up," on what yards do you commence ?	84
687. In "squaring in," on what yards do you commence ?	84
688. What should be done before you start bracing up ?	84
689. What should you be particularly careful about in bracing up ?	84
690. General questions on bracing up and squaring in	84
691.	
692.	
693.	
694.	

TACKING AND WEARING.

695. How does a vessel get to a point from which the wind is blowing ?	84
696. What is "tacking ?"	84
697. What is "wearing" ?	86
698. What are the situations for a crew of forty men for tacking ship ?	85
699. Describe the operation of tacking a ship	85
700. When you are tacking constantly, what will save time with regard to braces ?	86
701. What is "missing" stays ?	86
702. What do you do when a vessel "misses" stays ?	86
703. Why have you to "wear" ship sometimes ?	86
704. Describe the operation of "wearing" ship	86
705. What special care have you to take in "wearing" ship, and why ?	87
706.	
707.	
708.	
709.	

HEAVING TO.

710. What is "heaving to," and why is the operation performed ?	87
711. Suppose the wind on the quarter, how would you "heave to" ?	87
712. How would you "heave to" with the wind on the beam ? .	87
713.	
714.	
715.	
716.	
717.	
718.	
719.	

STEERING GEAR.

	PAGE
720. What is the steering apparatus ?	87
721. What are the two principal parts of steering apparatus ?	87
722. What is a rudder ?	87
723. How is a rudder attached to a ship ?	87
724. Describe the parts of a rudder	87
725. What is the rudder trunk ?	87
726. How is the rudder head fitted in the rudder trunk ?	87
727. What is the arrangement on the rudder head by which motion is transmitted to it ?	88
728. What is the helm or tiller ?	88
729. What are the orders given in steering the ship ?	88
730. How are tillers fitted to the rudder head ?	88
731. How are rudder heads usually fitted now ?	88
732. When the order "Port the helm" is given, which way does the rudder, and which way does the ship's head, go ?	88
733. What is the "wheel" ?	88
734. What is the general effect on the ship of moving the rudder ?	88
735. Where about is the centre of revolution of the ship when the rudder is put over ?	88
736. What is the general action of vessel when the rudder is first moved ?	88
737. What should the aim of the helmsman be in steering the ship ?	88
738. How near to her course should a modern mail steamer keep in smooth weather ?	88
739. How near to her course should it be possible to keep a cargo steamer, or sailing ship ?	88
740. In a sailing ship, when sailing "full and by," what forms a good guide for the steering ?	88
741. How should the officer determine the course made good when sailing "on a wind" ?	88
742. What should the helmsman do when he is relieved at the wheel ?	89
743. What should the officer of the watch do when the helmsman is changed ?	89
744. What affects the action of the rudder in steamers ?	89
745. What is the general effect of a right-handed propeller on the stern of a vessel ?	89
746. Which way is the bow of a vessel having a right handed pro- peller inclined to go when the ship is going ahead ?	89
747. Which way will the bow of a vessel with a right-handed pro- peller be inclined to go when going astern ?	89
748. Is the trim of a vessel likely to affect the steering ?	90
749. Does the theoretical action of the propeller always affect the steering as it is supposed to ?	90
750. What other matters are likely to affect the steering besides the action of the propeller ?	90
751.	90
752.	
753.	

754.	.	.	.	.	.	.	.
755.	.	.	.	.	.	.	.
756.	.	.	.	.	.	.	.
757.	.	.	.	.	.	.	.
758.	.	.	.	.	.	.	.
759.	.	.	.	.	.	.	.

RIGGING DERRICKS AND SHEERS.

760.	What are sheers ?	.	.	.	.	.	.	90
761.	What are sheers for ?	.	.	.	.	.	.	90
762.	What is a " derrick " ?	.	.	.	.	.	.	91
763.	How do you rig a " derrick " ?	.	.	.	.	.	.	91
764.	What advantage have sheers over a derrick ?	.	.	.	.	.	.	92
765.	How do you rig sheers ?	.	.	.	.	.	.	92
766.	.	.	.	.	.	.	.	92
767.	.	.	.	.	.	.	.	92
768.	.	.	.	.	.	.	.	92
769.	.	.	.	.	.	.	.	92
770.	.	.	.	.	.	.	.	92
771.	.	.	.	.	.	.	.	92
772.	.	.	.	.	.	.	.	92
773.	.	.	.	.	.	.	.	92
774.	.	.	.	.	.	.	.	92

SENDING UP MASTS.

775.	How do you send up a topmast ?	.	.	.	.	.	.	93
776.	What special care do you take in sending up a topmast at sea ?	.	.	.	.	.	.	93
777.	When is a convenient time to place the cross-trees ?	.	.	.	.	.	.	94
778.	How do you send up topmast rigging ?	.	.	.	.	.	.	95
779.	In what order is the topmast rigging put on ?	.	.	.	.	.	.	95
780.	How do you put on the topmast cap ?	.	.	.	.	.	.	95
781.	In what order do you set up the topmast rigging ?	.	.	.	.	.	.	95
782.	How do you send up a t'gallant and royal mast ?	.	.	.	.	.	.	95
783.	How would you place on the t'gallant and royal rigging ?	.	.	.	.	.	.	95
784.	How do you prevent the t'gallant and royal rigging slipping down over the mast ?	.	.	.	.	.	.	95
785.	In what order does the t'gallant and royal rigging go on ?	.	.	.	.	.	.	95
786.	In what order is the t'gallant and royal rigging set up ?	.	.	.	.	.	.	95
787.	.	.	.	.	.	.	.	95
788.	.	.	.	.	.	.	.	95
789.	.	.	.	.	.	.	.	95

D.—FORE-AND-AFT SAILING.

790.	What is the chief sail on a cutter ?	.	.	.	.	.	.	97
791.	How would you bend a cutter's mains'l ?	.	.	.	.	.	.	97

	PAGE
792. How would you set a cutter's mains'l ?	98
793. How would you reef a cutter's mains'l ?	99
794. How would you set a cutter's jib ?	99
795. How would you tack a cutter ?	101
796.	
797.	
798.	
799.	

HANDLING OF BOATS UNDER SAIL.

800. Why is it necessary that sailors should have some knowledge of boat-sailing ?	104
801. Do sailors, as a rule, get much opportunity of learning boat-sailing ?	104
802. What is the handiest rig for a sea-going boat ?	104
803. What ordinary rigs can you fit in sea-going boats ?	104
804. What is the best ballast for a sailing boat ?	104
805. Why is water the best ballast for a sailing boat ?	104
806. What is the water-ballast carried in ?	104
807. How should barécas be loaded with water-ballast ?	104
808. On what does the successful sailing of a boat in a great measure depend ?	104
809. Where should the crew be placed in a sailing boat when under way ?	104
810. What particular points should you attend to when sailing a boat ?	104
811. What is the most dangerous position for a sailing boat to be in ?	105
812. What is the best way to handle a boat with the wind and heavy sea on the beam ?	105
813. When should sail be reduced in a boat ?	105
814. How would you tack a boat fitted with a dipping lug ?	105
815. What would you do in a sailing boat if suddenly caught in a squall ?	105
816.	105
817.	
818.	
819.	
820.	
821.	
822.	
823.	105
824.	105
825.	105
826.	105
827.	105
828.	105
829.	105

SEA ANCHORS FOR BOATS.

	PAGE
830. What is a sea anchor ?	105
831. Of what would you make a temporary sea anchor for a boat ?	105
832. How would you secure the sea anchor to a boat ?	106
833.	106
834.	106
835.	106
836.	106
837.	106
838.	106
839.	106

LOWERING A BOAT AT SEA.

840. Before lowering a boat, what precaution should you take ?	106
841. To what should you specially attend when the boat is being lowered down to the ship's side ?	106
842.	106
843.	106
844.	106
845.	106
846.	106
847.	106
848.	106
849.	106

LANDING ON A BEACH.

850. Is it necessary to take any particular care in landing on a beach ?	106
851. Does the distance with which the sea breaks from the shore vary ?	106
852. Is it difficult to judge the state of the breakers from the sea ?	106
853. What is the cause of breakers ?	106
854. Why are breakers dangerous to boats ?	106
855. What particular precaution would you take in landing on a beach ?	106
856. In making your way out through breakers, what have you to be careful about ?	106
857.	106
858.	106
859.	106

ACCIDENTS.

860. What should be done when a man falls overboard ?	107
861. Which boat should be lowered to pick a man up who has fallen overboard ?	107

862. If a man falls overboard in a steamer, what should you at once do ?	107
863. Where should life-buoys be placed about a ship ?	107
864. Is it possible to pick up a man who has fallen overboard in very heavy weather, and how would you do it ?	107
865. General questions on accidents, &c.	107
866. What is the general treatment for restoring an apparently drowned person ?	107
867. What would you do when the sheet of a square sail carries away ?	108
868. Why do you haul up the gear before lowering the yard ?	108
869. What would you do if the downhaul of a jib carries away ?	108
870. What would you do if a brace carries away ?	108
871. What would you do if the sheet of a head sail carries away ?	108
872. What would you do if parrel of a yard carries away ?	108
873. If a spar carries away aloft, what is the first thing to do ?	108
874. What have you to be careful about with spars hanging about over a ship's side ?	109
875. What would you do if a lower lift carries away ?	109
876. What would you do if a yard or spar becomes sprung ?	109
877. Describe how you would fish a sprung spar	109
878. Suppose the ship is taken "aback," what must you endeavour to do ?	109
879. Suppose the ship is going along with the wind on the port quarter, and she is taken "aback" with the wind on the starboard beam, what would you do ?	109
880. Suppose a ship is going along with the wind on the port beam, and it suddenly shifts to the starboard bow, what would you do ?	109
881. Suppose you go along with the wind before the beam, and are struck by a sudden heavy squall, what would you do ?	109
882. If you are struck with a sudden squall with the wind abaft the beam, what would you do ?	109
883. Why is it dangerous to try to get the ship off the wind if struck by a sudden squall before the beam ?	109
884.	109
885.	109
886.	109
887.	109
888.	109
889.	109
890.	109
891.	109
892.	109
893.	109
894.	109
895.	109
896.	109
897.	109
898.	109
899.	109

ROCKET APPARATUS.

	PAGE
900. Describe the rocket apparatus, and its practical use . . .	109
901. Describe the general uses of oil in calming waves . . .	110
902.	110
903.	110
904.	110

PART V.

SIGNALS AND SIGNALLING.

905. How do vessels communicate with one another ? . . .	113
906. What are the different methods of signalling ? . . .	115
907. Describe the methods available for signalling in the day-time . . .	115
908. Describe the methods of signalling at night-time . . .	115
909. What is a quick method of communicating with another ship ? . . .	115
910. What is the great advantage of signalling by the Morse Code ? . . .	115
911. What is the International Code of Signals ? . . .	113
912. How many flags are there in the International Code of Signals ? . . .	113
913. What are one-flag signals ? . . .	113
914. What are two-flag signals ? . . .	113
915. What is a distinguishing mark of an attention signal ? . . .	113
916. What is a distinguishing mark of a compass signal ? . . .	114
917. What is an urgent signal ? . . .	113
918. What are three-flag signals ? . . .	114
919. What do general signals relate to ? . . .	114
920. What are four-flag signals ? . . .	114
921. What is the distinguishing mark of the name of a man-of-war ? . . .	114
922. What is the distinguishing mark of the name of a merchant ship ? . . .	114
923. How do you distinguish a geographical signal ? . . .	114
924. How should signalling be conducted ? . . .	114
925. How should signal halliards be fitted ? . . .	114
926. Where is signalling done from ? . . .	114
927. When much signalling is to be done, what is a convenient way of having the flags ? . . .	114
928. What are the distress signals available in the day-time ? . . .	114
929. What are the distress signals available at night-time ? . . .	114
930. What are the pilot signals available in the day-time ? . . .	115
931. What are the pilot signals available at night-time ? . . .	115
932. What is the sailing signal ? . . .	118

	PAGE
933. What is the Morse Code ?	118
934. What do you use with the Morse Code for signalling in the day-time ?	118
935. How do you use the flag in signalling with the Morse Code ?	118
936. How do you make a "dash" (—) with a flag or staff ?	118
937. How do you make a "dot" (.) with a flag or staff ?	118
938. How do you show (in the Morse Code) when you have finished the word ?	118
939. How do you signal with a Morse Code at night-time ?	118
940. How do you make the distinction between a dash and the dot in signalling with the lamp ?	118
941. Why is the Morse Code extremely useful ?	118
942. Questions on signal plate	118
943. General questions on signalling	118
944. What is "dipping the ensign" ?	119
945. What should you attend to when a flag is hoisted ?	119
946. What are the general rules for dipping the ensign ?	119
947.	119
948.	119
949.	119
950.	119
951.	119
952.	119
953.	119
954.	119
955.	119
956.	119
957.	119
958.	119
959.	119
960.	119
961.	119
962.	119
963.	119
964.	119
965.	119
966.	119
967.	119
968.	119
969.	119
970.	119
971.	119
972.	119
973.	119
974.	119
975.	119
976.	119
977.	119
978.	119
979.	119
980.	119
981.	119

	PAGE
982.	119
983.	119
984.	119
985.	119
986.	119
987.	119
988.	119
989.	119
990.	119
991.	119
992.	119
993.	119
994.	119
995.	119
996.	119
997.	119
998.	119
999.	119

RULES OF THE ROAD.

1000. What was the rule of the road formulated for ?	120
1001. What was the origin of the rule of the road ?	120
1002. What hours are lights supposed to be carried ?	120
1003. What does the word "visible" mean with regard to the lights ?	120
1004. What does the term "steam vessel" imply in the rule of the road ?	120
1005. What does the term "sailing vessel" imply in the rule of the road ?	120
1006. When is a vessel considered "under way" ?	120
1007. What lights shall a vessel at anchor carry ?	127
1008. Where shall a vessel at anchor exhibit her light ?	127
1009. What is the rule as to the visibility of the anchor light ?	127
1010. What are the variations in the rule of anchor lights of different sized vessels ?	127
1011. What lights shall a vessel aground in or near a fair way carry ?	127
1012. What lights shall a sailing-vessel when under way carry ?	122
1013. What lights shall a steamer when under way carry ?	120
1014. What are the variations in the rule for carrying the masthead light in different sized vessels ?	120
1015. Over what area should the side-lights show ?	121
1016. Over what area should the masthead light show ?	120
1017. How far should the masthead light be visible ?	120
1018. How far should the coloured side-lights be visible ?	121
1019. Can steamers carry any other lights ?	121
1020. How shall a vessel being overtaken by another vessel indicate her position ?	127
1021. Over what arc is the light of an overtaken vessel to show ?	127
1022. What lights shall a steamer towing carry ?	121

	PAGE
1023. What light shall a vessel carry if the length of a tow is over 600 feet ?	121
1024. What extra light may a vessel towing carry ?	121
1025. What lights can steam vessels of less than forty tons carry ?	123
1026. What lights can vessels, under oars or sails, of less than twenty tons carry ?	123
1027. What lights shall small launches, such as are carried by sea-going vessels, carry ?	123
1028. What lights shall a sailing pilot vessel, when on duty, carry ?	123
1029. What lights shall a steam pilot vessel on duty carry ?	124
1030. What lights shall a steam pilot vessel when anchored, but "on duty," carry ?	124
1031. How should a sailing pilot vessel when "under way" indicate to another ship the way she is going ?	131
1032. What lights shall a small pilot vessel, such as go alongside a ship, carry ?	123
1033. What shall a pilot vessel "under way," but not on duty, carry ?	124
1034. What lights shall telegraph ships carry, when "under way" at work on cables ?	122
1035. What marks of distinction shall be carried by telegraph ships when under way, and at work in the day-time ?	122
1036. What are the "sizes of the shapes" to be carried by telegraph ships ?	122
1037. What lights shall telegraph ships when at work, and making way through the water, carry ?	122
1038. What lights should a vessel not under command carry at night-time ?	121
1039. What distinguishing mark shall a vessel not under command carry in the day-time ?	121
1040. What lights shall a vessel not under command, but making some way through the water, carry ?	122
1041. What do the special lights carried by telegraph ships indicate ?	122
1042. What mark shall a steam vessel under sail only, with her funnel up, carry in the day-time ?	128
1043. How should steam vessels indicate their position by day, or night, or when involved in fog, mist, falling snow, or heavy rain storms ?	126
1044. How shall sailing vessels indicate their position during thick weather ?	125
1045. How shall a vessel being towed indicate her presence in thick weather ?	122
1046. How shall a vessel anchored in a fog, mist, falling snow, or heavy rain indicate her presence ?	127
1047. How long does a prolonged blast last ?	128
1048. What can be used in a Turkish vessel in lieu of a bell ?	128
1049. What could be used in a small sea-going vessel in lieu of a bell ?	129
1050. Is it necessary to take any great care in selecting the position from which to make sound signals in thick weather ?	128

	PAGE
1051. How should a vessel be navigated in a fog, mist, falling snow, or heavy rain storms ?	129
1052. How should a steam vessel under way indicate her presence during fog, mist, falling snow, or heavy rain storms ?	128
1053. How should a steam vessel stopped, but having no way on her, indicate her presence during fog, mist, falling snow, or heavy rain storms ?	128
1054. How should a sailing vessel indicate her presence on the star-board tack in thick weather ?	128
1055. How should a sailing vessel when under way indicate her presence when on the port tack in thick weather ?	128
1056. How should a sailing vessel when under way, with the wind abaft the beam, indicate her presence in thick weather ?	128
1057. How should a vessel when at anchor indicate her presence in thick weather ?	128
1058. How should a vessel, when towing a vessel employed in laying a telegraph cable, indicate her presence during thick weather ?	128
1059. How should a vessel under way, but not under proper command, indicate her presence during thick weather ?	128
1060. How should a vessel towed indicate her presence in thick weather ?	129
1061. How should sailing vessels and boats (under twenty tons burden) indicate their presence in thick weather ?	129
1062. What lights can be carried by small sailing vessels under way in bad weather when they find it difficult to carry their side-lights ?	122
1063. What lights can very small vessels, such as open boats, carry ?	124
1064. What particular care should be taken by vessels carrying lamps with coloured slides in them ?	124
1065. What lights should be carried by rowing boats under oars or sails ?	123
1066. When should rowing boats under oars or sails exhibit their lights ?	123
1067. What lights should a steam trawler carry, when not stationary and engaged in trawling ?	125
1068. What lights shall sailing trawlers carry when engaged in trawling and not stationary ?	125
1069. What lights should drift-net fishing vessels carry ?	126
1070. What lights should vessels engaged in line fishing carry ?	126
1071. In ordinary weather, how shall a fishing vessel, when stationary through her gear catching in a obstruction, indicate her position ?	126
1072. How should a fishing vessel indicate her position when stationary in a fog or mist ?	126
1073. How do fishing vessels, when at work, in a fog or mist, indicate their position ?	126
1074. What is the rule for a sailing vessel, when running free, with regard to other ships ?	129
1075. What is the rule for sailing vessels giving way when under different tacks ?	129

	PAGE
1076. What is the rule for a steamer when it meets a sailing ship ?	130
1077. Does a steamer always get out of the way of a sailing ship ?	130
1078. When two sailing vessels are meeting with the wind free in both cases, which one gives way ?	129
1079. Two steam vessels meeting one another end on, which one gives way ?	130
1080. Two steamers inclined to meet one another, which one gives way ?	133
1081. What is the rhyme for two steam vessels meeting ?	134
1082. What is the rhyme for two steam vessels passing ?	134
1083. What is the rhyme for two steam vessels crossing ?	134
1084. What is the position of greatest danger of two steamships under way ?	134
1085. Repeat what should vessels always do to avoid collisions	134
1086. What is the right side to keep in narrow channels ?	134
1087. What should the officer on watch do on sighting a light ?	134
1088. What are collisions often caused by ?	134
1089. What should a vessel that is in the right do in preference to altering her helm ?	134
1090. What are the sound signals by which one vessel can signal to another as course indicators when in sight of one another ?	131
1091. How would you define an overtaking vessel ?	131
1092. What can a vessel do to attract attention in addition to showing her ordinary lights ?	127
1093. What precaution should a vessel take in showing other than the regulation lights ?	127
1094. Are there any lights used by which steamers of different lines can be distinguished ?	134
1095. Under what conditions are extra lights allowed to be used for distinguishing the line to which the vessel belongs ?	134
1096. What should a vessel do on approaching squadrons of warships ?	134
1097.	134
1098.	
1099.	
1100.	
1101.	
1102.	
1103.	
1104.	
1105.	
1106.	
1107.	
1108.	
1109.	
1110.	
1111.	
1112.	
1113.	
1114.	
1115.	
1116.	

1117.	.	.	.	.	.	.	.
1118.	.	.	.	.	.	.	.
1119.	.	.	.	.	.	.	.
1120.	.	.	.	.	.	.	.
1121.	.	.	.	.	.	.	.
1122.	.	.	.	.	.	.	.
1123.	.	.	.	.	.	.	.
1124.	.	.	.	.	.	.	.
1125.	.	.	.	.	.	.	.
1126.	.	.	.	.	.	.	.
1127.	.	.	.	.	.	.	.
1128.	.	.	.	.	.	.	.
1129.	.	.	.	.	.	.	.
1130.	.	.	.	.	.	.	.
1131.	.	.	.	.	.	.	.
1132.	.	.	.	.	.	.	.
1133.	.	.	.	.	.	.	.
1134.	.	.	.	.	.	.	.
1135.	.	.	.	.	.	.	.
1136.	.	.	.	.	.	.	.
1137.	.	.	.	.	.	.	.
1138.	.	.	.	.	.	.	.
1139.	.	.	.	.	.	.	.
1140.	.	.	.	.	.	.	.
1141.	.	.	.	.	.	.	.
1142.	.	.	.	.	.	.	.
1143.	.	.	.	.	.	.	.
1144.	.	.	.	.	.	.	.
1145.	.	.	.	.	.	.	.
1146.	.	.	.	.	.	.	.
1147.	.	.	.	.	.	.	.
1148.	.	.	.	.	.	.	.
1149.	.	.	.	.	.	.	.
1150.	.	.	.	.	.	.	.
1151.	.	.	.	.	.	.	.
1152.	.	.	.	.	.	.	.
1153.	.	.	.	.	.	.	.
1154.	.	.	.	.	.	.	.
1155.	.	.	.	.	.	.	.
1156.	.	.	.	.	.	.	.
1157.	.	.	.	.	.	.	.
1158.	.	.	.	.	.	.	.
1159.	.	.	.	.	.	.	.
1160.	.	.	.	.	.	.	.
1161.	.	.	.	.	.	.	.
1162.	.	.	.	.	.	.	.
1163.	.	.	.	.	.	.	.
1164.	.	.	.	.	.	.	.
1165.	.	.	.	.	.	.	.
1166.	.	.	.	.	.	.	.
1167.	.	.	.	.	.	.	.
1168.	.	.	.	.	.	.	.

1169.	.	.	.	.	.	.	.
1170.	.	.	.	.	.	.	.
1171.	.	.	.	.	.	.	.
1172.	.	.	.	.	.	.	.
1173.	.	.	.	.	.	.	.
1174.	.	.	.	.	.	.	.
1175.	.	.	.	.	.	.	.
1176.	.	.	.	.	.	.	.
1177.	.	.	.	.	.	.	.
1178.	.	.	.	.	.	.	.
1179.	.	.	.	.	.	.	.
1180.	.	.	.	.	.	.	.
1181.	.	.	.	.	.	.	.
1182.	.	.	.	.	.	.	.
1183.	.	.	.	.	.	.	.
1184.	.	.	.	.	.	.	.
1185.	.	.	.	.	.	.	.
1186.	.	.	.	.	.	.	.
1187.	.	.	.	.	.	.	.
1188.	.	.	.	.	.	.	.
1189.	.	.	.	.	.	.	.
1190.	.	.	.	.	.	.	.
1191.	.	.	.	.	.	.	.
1192.	.	.	.	.	.	.	.
1193.	.	.	.	.	.	.	.
1194.	.	.	.	.	.	.	.
1195.	.	.	.	.	.	.	.
1196.	.	.	.	.	.	.	.
1197.	.	.	.	.	.	.	.
1198.	.	.	.	.	.	.	.
1199.	.	.	.	.	.	.	.

PART VI.

MECHANICAL APPLIANCES.

1200.	What are the principal mechanical appliances used on board ships ?	135
1201.	How are the mechanical appliances on board ship driven ?	135
1202.	What special precautions do you take with mechanical appliances ?	136
1203.	What are the mechanical appliances to be found on the bridge of a steamer ?	137
1204.	.	.
1205.	.	.
1206.	.	.
1207.	.	.
1208.	.	.

1209.	.	.	.	.	.	.	.
1210.	.	.	.	.	.	.	.
1211.	.	.	.	.	.	.	.
1212.	.	.	.	.	.	.	.
1213.	.	.	.	.	.	.	.
1214.	.	.	.	.	.	.	.
1215.	.	.	.	.	.	.	.
1216.	.	.	.	.	.	.	.
1217.	.	.	.	.	.	.	.
1218.	.	.	.	.	.	.	.
1219.	.	.	.	.	.	.	.

LIGHTHOUSES AND LIGHT-VESSELS.

1220.	What are the means of indicating to sailors the positions of points of land and shoals ?	139
1221.	How are lighthouses distinguished in the day-time ?	139
1222.	How are lighthouses distinguished in the night-time ?	139
1223.	What are lighthouses built of ?	139
1224.	How are lighthouses and light-vessels distinguished in fogs ?	139
1225.	Name the various kinds of lights used in lighthouses and light-vessels	139
1226.	What is the general illuminant used in lighthouses and light-vessels ?	139
1227.	What are the two general systems of lamps now used in light-houses and light-vessels ?	140
1228.	What is the general system used in the best lighthouses and light-vessels ?	140
1229.	What are " buoys " ?	141
1230.	Describe the different kinds of buoys	141
1231.	How are the different sides of a channel marked ?	141
1232.	What are beacons ?	141
1233.	Name the different kinds of beacons	141
1234.	.	141
1235.	.	.
1236.	.	.
1237.	.	.
1238.	.	.
1239.	.	.

HOLDS AND CARGO.

1240.	What is the general duty of an officer as regards a hold ?	142
1241.	Describe how you could prepare a hold for cargo ?	142
1242.	What are mixed cargoes ?	142
1243.	What are homogeneous cargoes ?	142
1244.	How is petroleum carried in vessels ?	142
1245.	What is dunnage ?	143
1246.	What is dunnage used for ?	143
1247.	What is " sweating " ?	144

	PAGE
1248. How should casks of liquid be stowed ?	145
1249. What particular care would you take in stowing explosive and bad-smelling goods ?	145
1250. How is frozen meat carried ?	145
1251. What precautions would you take in stowing a heavy cargo such as iron ?	145
1252. What particular care should an officer take to ensure the safety of a ship when a cargo is stowed ?	145
1253. What is "tallying" ?	146
1254. What should an officer do if he finds cargo damaged ?	146
1255.	
1256.	
1257.	
1258.	
1259.	

PAINTING, CHIPPING, AND SCRAPING.

1260. What precautions should you take when painting in a hatchway	146
1261.	
1262.	
1263.	
1264.	
1265.	
1266.	
1267.	
1268.	
1269.	

USING A GANTLINE.

1270. What precautions do you take in using a gantline for lower- ing or raising a man ?	146
1271.	

HATCHES.

1272. How do you secure hatches ?	147
1273.	

FIRE.

1274. What are fire stations ?	147
1275.	
1276.	
1277.	
1278.	
1279.	

POINTS OF ETIQUETTE : KEEPING AND RELIEVING WATCH, ETC.

	PAGE
1280. Why is it well to attend questions of etiquette on board ship ?	154
1281. What should you do when you step on board over the gangway of a ship ?	154
1282. What is the general method of saluting ?	154
1283. What should the officer do when he relieves another officer ?	155
1284. What should the officer, when he is being relieved, see that his relief does ?	155
1285. What is the night order-book ?	155
1286. What is the night order-book for ?	155
1287. What is the deck department in a steamer responsible for ?	155
1288. Why is it necessary that the deck and engine-room department should work amicably together ?	155
1289. What should the officer on watch do when he wants water for washing decks, or steam on the winches or windlass ?	155
1290. What should the officer on watch do when he has finished with steam on the winches ?	155
1291. What should the person who strikes the bells at night-time do ?	155
1292. What should the look-out man do when the bell is struck ?	155
1293. What is the standing rule for the officer on watch, or the look-out man ?	155
1294. How can the officer on watch communicate with the captain ?	155
1295. What should the officer on watch do when passing a point of land, or lighthouse ?	156
1296. What should the officer on watch do with regard to the compass ?	156
1297. What should the officer on watch do when he has any doubt as to what course to pursue under any circumstances ?	155
1298.	156
1299.	
1300.	
1301.	
1302.	
1303.	
1304.	
1305.	
1306.	
1307.	
1308.	
1309.	

GENERAL TOOLS IN USE ABOARD SHIP.

MAXIMS, ETC.

	PAGE
1310. Questions on maxims	156
1311. What are the load-line marks	157
1312.	
1313.	
1314.	

TABLES

1315. Where should the ship's name and port of registry be painted ?	157
1316.	
1317.	
1318.	
1319.	

SEA TERMS.

1320. General questions on sea terms.	168-190
1321.	
1322.	
1323.	
1324.	
1325.	
1326.	
1327.	
1328.	
1329.	
1330.	
1331.	
1332.	
1333.	
1334.	
1335.	
1336.	
1337.	
1338.	
1339.	

The making and rigging up of models is a great assistance—in the absence of actual fitting—in learning practical seamanship.

WEATHER FORECASTING.

	PAGE
1340. What is the first thing to learn in weather forecasting ?	191
1341. What are the regular daily movements of the barometer in the tropics ?	191
1342. What are the main types of clouds ?	191
1343. What is a cirrus cloud ?	191
1344. What is a stratus cloud ?	191
1345. What is a cumulus cloud ?	191
1346. What are the first indications of a change of weather ?	198
1347. What have you to guard against as a storm centre passes over the ship ?	199
1348. Give some general weather indications of (a) fine weather,	199
(b) bad weather ?	199

INDEX¹

A

"ABOUT SHIP," 85
 Accidents, 108, 109
 Action of water on rudder and ship,
 88
 Amber line, 15
 Anchor-buoys, 63
 Anchor foul, 62
 Anchoring a sailing ship, 64
 a steamer, 64
 Anchors and cables, 60
 Anchors, securing, 62
 watch, 13
 Anvil, 71
 Apprentice, 149
 Arming, 47
 Azimuth Vane, 10

B

BACKSTAYS, 38
 Bale, slinging a, 22
 Barécas, 105
 Battens, 56
 Beacons, 142
 Beams, 1
 Becketts for yards, 39
 Belaying a rope, 12
 Belaying-pins, 12
 Bells, 13
 Bending a course, 77, 78
 Bending and unbending a driver,
 or spanker, 79
 Bending and unbending a jib, 79
 sails, 77
 slab, 1

Bends, 15, 16
 Bill-boards, 62
 Blackwall hitch, 20
 Blocks, 51
 Boating, 5
 Boat, capacity of, 164
 landing on a beach, 106
 lowering, 106
 sailing, 104
 sails, 72, 104
 Boats' storage, 7
 Bobstays, 38
 Books for sea, 152
 Bowline, 20, 42
 Bowlines, 42
 Bowsprit, 38
 shrouds, 38
 Brace, carried away, 108
 pendants, 39
 Braces, 39
 Bracing up, 82, 84
 Brails, 42
 Bridge of steamer, 138
 Building a ship, 1
 Built masts, 37
 Bullivants' steel wire, 31
 Buntlines, 41
 Buoying anchors, 63
 Buoys, 63, 160

C

CABLE, 60
 shackles, 62
 Cable-laid ropes, 15
 Cables, marking, 63
 Can hooks, 22
 Canvas, 71

¹ Many things not indexed here will be found in the Glossary.

Cap backstays, 38
 shrouds, 38
 Capstan, 136
 Care of wire ropes, 27
 Cargo, 142
 derrick, 91
 slings, 22
 Casks, slinging, 22
 to measure, 164
 Cat stopper, 62
 Catch ratline, 60
 Catching a crab, 5
 Catspaw, 20
 Caution, 146
 in depending on theoretical
 considerations, 90
 Certificates, 149
 second mate's, 149
 Chafing gear, 33, 56, 72
 Chain locker, 60
 Chipping, 146
 Cleaning holds, 142
 Clearing hawse, 65
 Cleats, 12
 Clewlines, 42
 Clinch, 20
 Clinometer, 10
 Clouds, 191
 Clove-hitch, 16
 Codline, 15
 Coiling ropes, 16
 Coir rope, 15
 Colour test, 151
 Commercial code of signals, 113
 Compass, 8
 Compass card, 9
 bearings, 8
Conway, 149
 Cradle, 2
 Cranes, 39
 Creasing stick, 71
 Cringles, 75
 Cross-bearings, 8, 10
 Cross-trees, 38
 Cut splice, 23
 Cutting canvas, 72
 gores, 72

D

DAVITS, 7
 Deadeyes, 38
 Deep sea lead, 47

Derrick, 91
 Description of parts of hull, 2
 Dipping the ensign, 119
 Disadvantage of staysails, 83
 Displacement table, 159
 Distress signals, 114
 Dog watches, 12
 Double wall, 16
 Double wall and crown, 16
 Downhaul carries away, 109
 Downhauls, 42
 Drowned, restoring apparently,
 107
 Dunnage, 143

E

EARING, passing an, 78
 Earings, 78
 Effect of propeller on steering, 89
 Effect of water on the rudder, 89
 End seizings, 146
 Engine-room telegraphs, 139
 Ensign, 119
 Etiquette, 154
 Eye splice, 23

F

FIDS, 71
 Fife rails, 12
 Figure of Eight, 16
 Fire, 147
 Firms carrying apprentices, 152
 Fishing spars, 109
 Fitting gear to a course, 41
 of shrouds, 55
 of stays'ls, 42
 of tackles, 52
 of topgallant yards, 69
 of yards, 38
 Flat keel plate, 2
 Flat seam, 73
 Flinders bar, 11
 Fog-horns, 129
 Foot-ropes, 39
 Fore-and-aft sail, 44
 sailing, 97
 Forecasting the weather, 191
 Foul hawse, 65
 Frames, 1
 Futtock rigging, 5

G

GAFFS, 39, 40
 Gammoning, 38
 Gantline, 146
 Gaskets, 81
 Getting anchors aboard, 62
 Getting under weigh in a sailing vessel, 64
 Girders, 1
 Glossary, 168
 Going aloft, 4
 Gooseneck, 39
 Gore, 72
 Grease horn, 71
 Grommet strop, 52
 Gudgeons, 87
 Guess warp, 7, 68
 Gymbals, 9
 Gybing or wearing a yacht, 101

H

HALLIARDS, 39
 Hand lead, 46
 Handling boats under sail, 104
 Hatches, 147
 Hawser-laid rope, 15
 Hawsers, 16
 Heaving lead, 47
 Heaving line, 68
 Heaving to, 87
 Heaving up anchor, 62
 Heeling error, 11
 Helm orders, 88
 Helmsman, 88
 Helm signalling apparatus, 139
 Hitches, 16
 Hoisting yards, 79
 Holds, 142
 Hooks, 29
 Horseshoe splice, 23, 24
 Hull, description of parts of, 2
 Hurricane, 191

I

INSTRUMENTS for sea, 152

J

JACKSTAYS, 39
 Jib, 42
 Jib sheet, 42

Joining rope by "marrying," 45
 Judging distance, 141
 Junior officers, duties of, 154

K

KEEL, 2
 Knots, 16

L

LAMPS, 134
 Landing on a beach, 106
 Lanyards, 38, 55
 Launching way, 2
 Laying out an anchor, 66
 Lead, 46
 Leadsman, 47
 Leaving ship in a boat, 7
 Leechlines, 41
 Leeway, 83
 Life-buoys, 107
 Lifts, 39
 Lighthouses, 139
 Light-vessels, 139
 Lights at anchor, 126, 127
 drift-net fishing, 124
 fishing vessels, 124, 125
 vessel stationary, 126
 in very small vessels, 122,
 123
 line fishing, 127
 pilot vessels, 123, 124
 sailing ships, 122
 sailing trawlers, 125
 ship, 134
 steam trawlers, 125
 steamers, 120
 telegraph ships, 122
 towing, 121
 vessels not under command,
 121
 Lining cloths, 72
 Load-line marks, 157
 Log-line, 49
 Log-ship, 49
 Long splice, 23
 Lowering a boat, 7
 at sea, 106
 Lower lift carries away, 109
 lifts, 39
 rigging, 38
 Lubber's line, 10

M

"MAKES" of wire rope, 31
 Making a sail, 73
 Man overboard, 109
 Marking cable, 63
 Marking log-line, 49
 Marks of lead-line, 46, 47
 Marline, 15
 Marline hitch, 20
 Marline-spike, 11
 Marline-spike hitch, 20
 "Marrying" two ropes, 45
 Mast coat, 56
 Masts, 3, 37
 Match sailing, 102
 Matthew Walker, 16
 Maxims, 156
 Measurement of ropes, 15
 Mechanical appliances, 135
 Middle stitch, 74
 Midshipman, 149
 Missing stays, 86
 Mooring, 65, 68
 Mooring shackle, 66
 Morse Code, 118
 Mould loft, 1

N

NAMES of parts of sails, 43
 Narrow channels, navigating, 134
 Needles, 71
 Nets, 34
 Netting, 34
 Night order-book, 155

O

OAR, 6, 7
 Officer of watches, duties, 154
 Oil for stilling waves, 110
 Opening a coil of rope, 16
 Order of setting up rigging, 38
 Orders for pulling, 7
 Ordinary certificate, 149
 Outfit of apprentice, 151
 Outhauls, 42
 Outtrigger, 38
 Overhauling cables, 63

P

PAINTING, 146
 Palm, 71

Parbuckle, 20
 Parcel, to, 35
 Parrel, 39
 Parrel carries away, 108
 Patent logs, 50
 sounding-machines, 47
 Pennants, 113
 Pilot signals, 115
 Pintles, 87
 Plain sail, 84
 Plating, 1
 Port of Registry, 157
 Practising rules of road, 119
 Pricker, 71
 Private signals, 134
 Propeller and rudder, 89
 Propeller action in steering, 89
 Pulling orders, 7
 Purchases, 52

Q

QUADRANTAL correctors, 11
 Quarter seizing, 46

R

RACKING, 46
 Rates of pay, 151
 Ratline stuff, 15
 Rattling down, 59
 Reef knot, 16
 Reef tackles, 42
 Reliefs, 155
 Relieving the wheel, 89
 Ribbands, 2
 Rigging, 4, 37, 56
 screws, 28
 setting up, 56
 in steamers, 56
 Rigs, 4
 Rocket apparatus for saving life,
 109
 Rolling hitch, 16
 Rope-end fittings, 29, 30
 Ropes, 15
 Ropes and cables compared, 33
 Ropes, how measured, 15
 shrinking, 84
 Rope table, 31
 Rope-yarn knot, 17
 Roping, 74
 Round seam, 73

Round seizing, 46
 Round turn and two half hitches,
 16
 Rovings, 77
 Rowing orders, 7
 Royal rigging, 95
 Rubber, 71
 Rubbing down seams, 73
 Rudder, 87
 trunk, 87
 Running gear, 41
 Rules of the road and diagrams,
 119, 120
 in rhyme, 132
 remarks on, 119, 134
 sailing vessels, 122
 steamers, 120

S

SAILCLOTH, 71
 Sail hook, 71
 Sailing signal, 113
 Sailmaker's whipping, 40
 Sailing, 71
 Sail rope, 77
 Sails, 3, 77
 bending, 77
 boat, 72
 setting, 79
 unbending, 77
 Salutes, 154
 Sea service, 149
 life, 149
 Semicircular correctors, 11
 Setting a tops'l, 79
 Scraping, 146
 Screws, 28, 38, 57, 58
 Scribe board, 1
 Sculling, 8
 Sea anchors for boats, 105
 Seams, 73
 Sea terms, 168
 Securing anchors, 62
 to cable, 60
 Seizings, 45
 Selvagee stop, 20
 Sending up a topmast, 93
 cross-trees, 94
 topgallant mast, 95
 yards up and down, 69
 Sennit, 35
 Serve, to, 36

Service, 36
 Setting a course, 80
 a driver, 80
 a jib, 80
 a spanker, 80
 a topgallant sail, 79
 sail, 79
 up rigging, 56
 with screws, 57
 Shank painter, 62
 Shapes carried, 122
 Sheepshank, 20
 Sheer-pole, 59
 Sheers, 90
 Sheet bend, 19
 carries away, 108
 Sheets, 42
 Ship's name, 157
 Short splice, 23
 Shroud knot, 16
 Shrouds, 38
 to fit, 55
 Side-lights, 134
 Side stitch, 74
 Sides of a ship, 2
 Signalling, 113, 118
 with warships, 118
 Signals, 113
 one-flag, 113
 two-flag, 113
 three-flag, 114
 four-flag, 114
 Single wall, 16
 and crown, 16
 Skin, 1
 Slabline, 41
 Slacking gear in wet weather, 84
 Slings, 20, 22, 38
 cargo, 22
 Sluice valves, 3
 Snatch block, 54
 Sound signal, at anchor, 128
 in fogs, 114, 128
 when under way, 128
 Sound signals, 128, 141
 Sounding, 47
 machine, 147
 table, 157
 Spanish windlass, 51
 Spanker boom, 40
 Spar carries away, 108
 Spare set lights, 134, 156
 Spars, 4

Speed indicators, 149
 Speed of ship by revolutions, 51
 Spilling lines, 41
 Splicing, 23
 Spun yarn, 15
 Squadrons, meeting, 134
 Squall strikes ship, 109
 Square sail fitting, 43
 Squaring in, 84
 Starting yachts, 102
 Stationing of hands for tacking, 85
 Stay, 38
 Stays, 38, 55
 Stays where they lead to, 38, 56
 Staysail, bending a, 79
 Stays'ls, 42, 79, 81
 Steam steering, 88, 138
 Steam winch, 135
 Steam windlass, 137
 Steering gear, 87, 137 ; orders, 88
 Stirrups, 39
 Stopper, 19 ; knot, 16
 Stopping up gear, 42
 Storage of paints, 146
 Storm areas, 198
 Stowing casks, 145
 sails, 80
 Striking the bell, 13
 Stropping blocks, 52
 Struck by a squall, 109
 Swifter, 38
 Swivel, 30

T

TABLES, 158
 Tabling, 72
 Tacking, 84
 a yacht, 101
 Tackles, 52
 Tacks, 41
 Taken aback, 109
 Taking a rope out in a boat, 7
 Taking in a course, 80
 driver, 81
 jib, 81
 lower topsail, 80
 royal, 80
 sail, 80
 spanker, 81
 staysail, 81
 topgallant sail, 80

Tallying, 146
 Tanks, 164
 Tarpaulin canvas, 72
 Tarring down rigging, 60
 Telemotor, 88
 Tending ship in tideway, 68
 Test of good canvas, 72
 Throat seizings, 46
 Tiller, 87
 Timber hitch, 16
 Time, 12
 Tools, sailmaker's, 71
 Top, 38
 Topgallant rigging, 95
 Topmast rigging, 95
 Topmast, sending up, 93
 Topmasts, 38, 93
 Topping rope, 70
 Topsail yards, getting aloft, 69
 Trestle-trees, 37
 Trimming sail, 81, 83
 Trim of yards, 81, 83
 Tripping lines, 42, 69, 81
 Trusses, 38
 Tub or parrel, 39
 Twine, 72
 Tyes, 39
 Types of vessels, 143

U

UNBENDING sails, 77
 Uniform, 156
 Unmooring, 65
 Useful information, 158
 Use of oil in seas, 110
 Use of helm taking in sail, 42, 81
 of nets, 34

V

VANGS, 40
 Various ways of signalling, 115

W

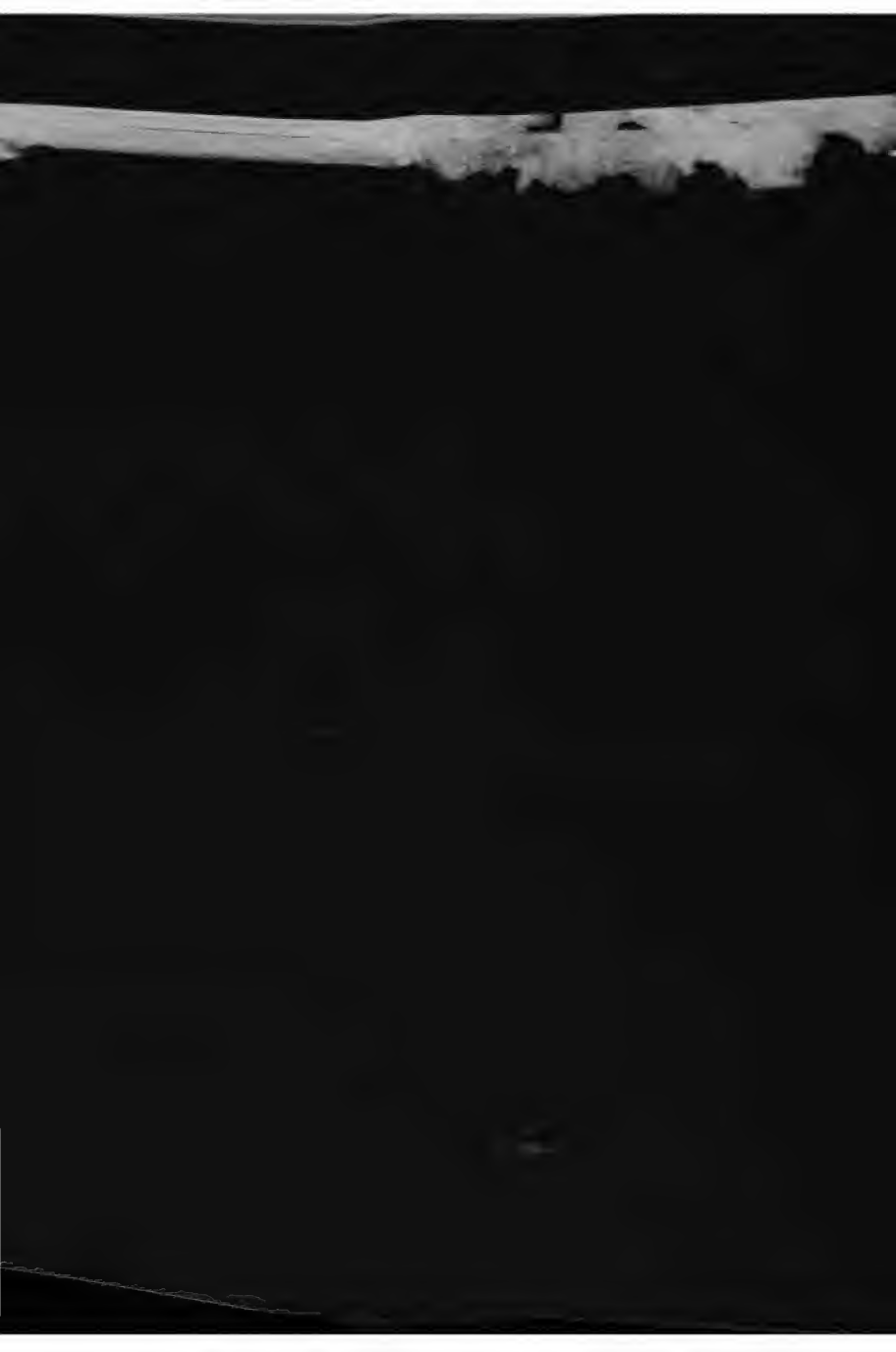
WARNING sign, 146
 Warp and weft, 72
 Warps, 16
 Warships, meeting, 134
 Warships, signalling with, 118
 Watch, taking charge of a, 155
 Watches, 12

Water-tight doors, 2
Wearing, 86
Weather forecasting, 191
Weather warnings, 156, 165, 198
Weight of water, 158
West-country whippings, 40
Wharf, making fast to a, 68
Wheel, 88
Whippings, 40
Wind force, 166
Windlass, 137
Windlass, steam, 137
Wind's effect on sails, 83
Wire rope, 15, 31

Wire sail roping, 74
Wire splicing, 23
Worcester, 149
Worm, to, 35
Wreck signal, 115

Y

YACHT sailing, 97
 sails, fitting of, 97
Yard sprung, 109
Yards, 38
 sending up and down, 69



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